Assessment of Dam Safety
Coal Combustion Surface Impoundments
Draft Report

American Electric Power
General James Gavin
Power Plant

Cheshire, Ohio

Prepared for

Lockheed Martin

2890 Woodridge Ave #209
Edison, New Jersey 08837

July 2, 2009

CHA Project No. 20085.4000.1510

CHA

I acknowledge that the management units referenced herein:

- Bottom Ash Pond
- Stingy Run Ash Disposal Pond

Has been assessed on June 1, 2009 and June 2, 2009.

Signature: ______________________________________

Malcolm D. Hargraves, P.E.
Senior Geotechnical Engineer
Registered in the State of Ohio

Signature: ______________________________________

Katherine E. Adnams, P.E.
Senior Geotechnical Engineer

Reviewer: ______________________________________

Warren A. Harris, P.E.
Geotechnical Operating Manager

TABLE OF CONTENTS

SECTION **PAGE NUMBER**

1.0 INTRODUCTION & PROJECT DESCRIPTION 1
1.1 Introduction 1
1.2 Project Background 2
1.2.1 State Issued Permits 2
1.2.1.2 Bottom Ash Pond 2
1.2.1.3 Stingy Run Dam 3
1.3 Site Description and Location 3
1.3.1 Other Impoundments 4
1.4 Previously Identified Safety Issues 4
1.5 Site Geology 5
1.6 Bibliography 5

2.0 FIELD ASSESSMENT 7
2.1 Visual Observations 7
2.2 Visual Observation – Bottom Ash Pond 8
2.2.1 Embankments and Crest 8
2.2.1.1 South Dike 8
2.2.1.2 East Dike 9
2.2.1.3 North Dike 10
2.2.1.4 West Dike 11
2.2.2 Bottom Ash Outlet Control Structure and Discharge Channel 11
2.3 Visual Observations – Stingy Run Dam 11
2.3.1 Embankments and Crest 12
2.3.2 Stingy Run Dam Outlet Control Structure 12
2.3.3 Stingy Run Dam Discharge Channel 12
2.3.4 Stingy Run Abandoned Emergency Spillway 13

3.0 DATA EVALUATION 15
3.1 Design Assumptions 15
3.2 Hydrologic and Hydraulic Design 15
3.2.1 Hydrologic and Hydraulic Design – Bottom Ash Pond 15
3.2.2 Hydrologic and Hydraulic Design – Stingy Run Dam 16
3.3 Structural Adequacy & Stability 17
3.3.1 Bottom Ash Pond 17
3.3.2 Stingy Run Dam 22
3.4 Operations & Maintenance 25

TABLE OF CONTENTS - continued

SECTION **PAGE NUMBER**

4.0 CONCLUSIONS/RECOMMENDATIONS 26
4.1 Acknowledgement of Management Unit Condition 26
4.2 Maintaining Vegetation Growth 26
4.3 Bottom Ash Pond South Dike Upstream Slope Stabilization and Wet Area........ 26
4.4 Bottom Ash Pond South Dike Wet Area 27
4.5 Bottom Ash Pond East Dike Erosion........ 27
4.6 Bottom Ash Pond East Dike Repair of Rodent Holes 27
4.7 Bottom Ash Pond East Dike Tree and Stump Removal 27
4.8 Bottom Ash Pond North Dike Runoff from Flushing the Conveyor........ 28
4.9 Bottom Ash Pond Hydraulic Analysis........ 28
4.10 Stingy Run Dam Hydraulic Analysis........ 29
4.11 Recommendations for Additional Stability Analyses – Bottom Ash Pond........ 29
4.12 Stingy Run Dam Recommendations for Additional Stability Analyses........ 30
4.13 Stingy Run Dam Outlet Structure Access........ 31
4.14 Stingy Run Dam Destroyed Instrumentation........ 31

5.0 CLOSING 32

TABLES

Table 1– Approximate Precipitation Prior to Site Visit........ 7
Table 2 - Comparison of Design Assumptions........ 16
Table 3 - Minimum Safety Factors Required 17
Table 4 - Soil Strength Parameters Used in BBCM June 2009 Draft Investigation Report........ 19
Table 5 – Summary of Safety Factors........ 20
Table 6 - Soil Strength Parameters Used in the 1986 Dam Raising Evaluation........ 22
Table 7 – Summary of Safety Factors – Stingy Run Dam........ 23

1.0 INTRODUCTION & PROJECT DESCRIPTION

1.1 Introduction

CHA was contracted by Lockheed Martin to perform site assessments of selected coal combustion surface impoundments (Project #0-381 Coal Combustion Surface Impoundments/Dam Safety Inspections). As part of this contract, CHA was assigned to perform a site assessment of American Electric Power's (AEP) General James Gavin Power Plant, which is located in Cheshire, Ohio as shown on Figure 1 – Project Location Map.

CHA made a site visit on June 1, 2009 and June 2, 2009 to inventory coal combustion surface impoundments at the facility, to perform visual observations of the containment dikes, and to collect relevant information regarding the site assessment.

CHA Engineers Malcolm Hargraves, P.E. and Katherine Adnams, P.E. were accompanied by the following individuals:

Company or Organization	**Name and Title**
American Electric Power	Gary Zych, Geotechnical Engineer
American Electric Power	Shah Baig, Geotechnical Engineer
American Electric Power	Christina Svoboda, Environmental Specialist
American Electric Power	Doug Workman
American Electric Power	Jeff Mullins
American Electric Power	Don Anderson
Environmental Protection Agency	Nate Nemani
Ohio EPA	Brian Queen
Ohio Dam Safety	Keith Banachowski (June 1st only)
Ohio Dam Safety	Mark Ogden (June 2nd only)

1.2 Project Background

The bottom ash pond and the Stingy Run Dam at the General James Gavin Power Plant are under the jurisdiction of the Ohio Department of Natural Resources (DNR) Division of Water – Dam Safety program. These impoundments are listed on the National Inventory of Dams (NID) with the following identification numbers:

Impoundment	NID ID	Ohio ID
Bottom Ash Pond	OH00971	8720-003
Stingy Run Dam	OH00919	8721-009

These impoundments are classified by Ohio DNR as Class I dams, which are likely to cause loss of life in the event of an unexpected breach.

1.2.1 State Issued Permits

AEP has received the following state issued permits for the Bottom Ash Pond and Stingy Run Dam:

1.2.1.2 Bottom Ash Pond

Ohio State Permit No. OH0028762 has been issued to AEP authorizing discharge under the National Pollutant Discharge Elimination System (NPDES) to the Ohio River in accordance with effluent limitations, monitoring requirements and other conditions set forth in the permit. The permit became effective on August 1, 2008 and will expire on January 31, 2013. (Note this permit also covers Stingy Run Dam and other surface runoff locations not containing coal combustion waste controlled by AEP on the site.)

1.2.1.3 Stingy Run Dam

Ohio State Permit No. OH0028762 has been issued to AEP authorizing discharge under the National Pollutant Discharge Elimination System (NPDES) to the Ohio River in accordance with effluent limitations, monitoring requirements and other conditions set forth in the permit. The permit became effective on August 1, 2008 and will expire on January 31, 2013. (Note this permit also covers the Bottom Ash Pond and other surface runoff locations not containing coal combustion waste controlled by AEP on the site.)

The Ohio Department of Natural Resources Division of Water issued Permit No. 87-159 for the dam raising in 1987.

In 1997 a Spillway Variance Request was submitted to OH DNR Division of Water as part of the permitting process for the landfill which is now located at the outlet of the original emergency spillway. This request was deemed reasonable by OH DNR.

1.3 Site Description and Location

Figure 2A – Site Plan shows the two management units constructed for the General James Gavin Power Plant. The Bottom Ash Pond is located on the south side of the plant, and the Stingy Run Dam is located on Stingy Run about 2.25 miles northwest of the plant. Stingy Run is a tributary to Kyger Creek that ultimately discharges into the Ohio River about 2 miles south of the Gavin Power Plant.

The Bottom Ash Pond is a four sided, diked impoundment that receives bottom ash, pyrite, and yard drainage for disposal. The Bottom Ash Pond was constructed in 1974, and is an approximately 36-foot high homogeneous earth fill. The created basin area is about 85 acres. Figure 2B is a site plan for the Bottom Ash Pond. Figure 3 shows a typical cross section of the dikes creating this impoundment.

Stingy Run Dam was formerly used for fly ash disposal. Its use as an active fly ash disposal site was discontinued in 1994. However, the reservoir still contains previously deposited fly ash. The Stingy Run Dam was originally constructed in 1974 to a height of about 90 feet. The dam was raised in 1988 and is now about 144 feet high. This dam in its raised condition was designed to have a surface area of about 325 acres. Because the site was discontinued for use, the impoundment only has a surface area of about 280 acres based on the aerial photos used in Figure 2C. This area includes an area only a few feet above the current operating pool that is covered fly ash. The Stingy Run discharges into Kyger Creek, which is a tributary to the Ohio River. Figure 2C shows the Stingy Run Impoundment and Figure 4 shows a cross section of the current (raised) dam construction.

A map of the region indicating the location of the General James Power Plant Bottom Ash Pond and Stingy Run Dam and identifying schools, hospitals, or other critical infrastructure located within approximately 5 miles down gradient of the ash pond is provided as Figure 5.

1.3.1 Other Impoundments

CHA also observed two connected impoundments adjacent to the currently operational landfill site. AEP reported that these ponds collect storm water runoff and leachate from the landfill and are permitted as part of the landfill operation. CHA did not perform an inspection of these impoundments, but did note that they appear to be lined with geosynthetic liner.

Four shallow storm water runoff collection ponds are located around the perimeter of the coal pile.

1.4 Previously Identified Safety Issues

Based on our review of the information provided to CHA and as reported by AEP, there have been no identified safety issues at either the Bottom Ash Pond or Stingy Run Dam in the last 10 years.

1.5 Site Geology

Based on a review of available surficial and bedrock geology maps, and reports by others, the site is in an unglaciated area of Ohio. The local geologic conditions at the Bottom Ash Pond are likely to consist of an alluvial silt, clay and/or sand deposited by the Ohio River flood waters, and glacial outwash sand and gravel deposits overlying bedrock categorized as part of the Conemaugh Formation, which consists predominantly of interbedded shales, sandstones, coal and limestone. At Stingy Run Dam, which is outside of the floodplain, the surficial materials are likely colluvium resulting from local bedrock, and scattered areas of residuum. The mapped adjacent bedrock formation is part of the Monongahela Formation, which consists of similar interbedded sedimentary rocks as the Conemaugh Formation with the exception of the limestone.

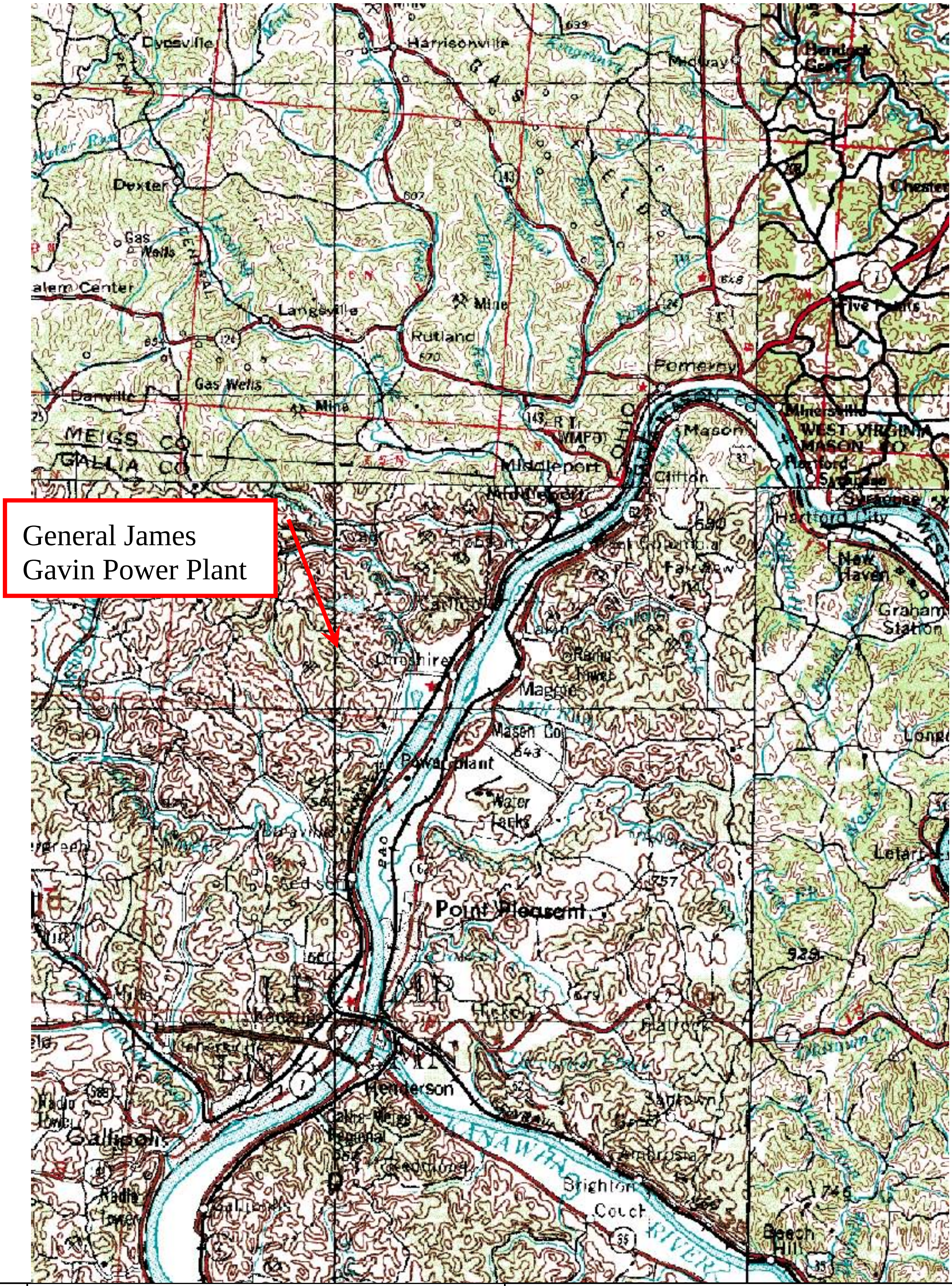
1.6 Bibliography

Following the impoundment failure in Tennessee in December 2008, AEP, realizing they did not have current stability analyses of the Bottom Ash Pond dikes, hired a consultant to perform a geotechnical assessment to provide an indication as to the level of safety provided by the embankment dam surrounding the bottom ash pond. The scope of work included the advancement of borings, laboratory testing and analyzing the stability of the Bottom Ash Pond. A draft version of this updated stability report dated June 5, 2009 was forwarded to CHA following our site visit and was reviewed with other documents for the preparation of this report.

Other documents that CHA reviewed in preparing this report include:

- Various *Dam & Dike Inspection Checklists*, dated April 2005 through October 2008, American Electric Power
- Various *Dike & Dam Inspection Reports,* dated 2004 through 2009, American Electric Power
- *Deformation Review Report of Survey*, November 17, 2008, American Electric Power

- *Gavin Generating Plant Bottom Ash Pond Investigation*, June 5, 2009, BBCM Engineering, Inc.
- *Preliminary Design Report Proposed Dan Raising for Phase II Stingy Run Fly Ash Retention* Pond, March 1986, American Electric Power Service Corporation
- *Final Design Report Proposed Dan Raising for Phase II Stingy Run Fly Ash Retention* Pond, December 1986, American Electric Power Service Corporation
- Variance Request Stingy Run Fly Ash Dam, July 1997, American Electric Power
- Selected drawings from dam raising at the Stingy Run Dam
- Selected original construction drawings of the Bottom Ash Pond.



N	**Figure 1** **Project Location Map**	
Scale: 1" = 2 miles	**Project No.:** **20085.4000.1510**	**American Electric and Power Company** **General James Gavin Power Plant** **Cheshire, Ohio**

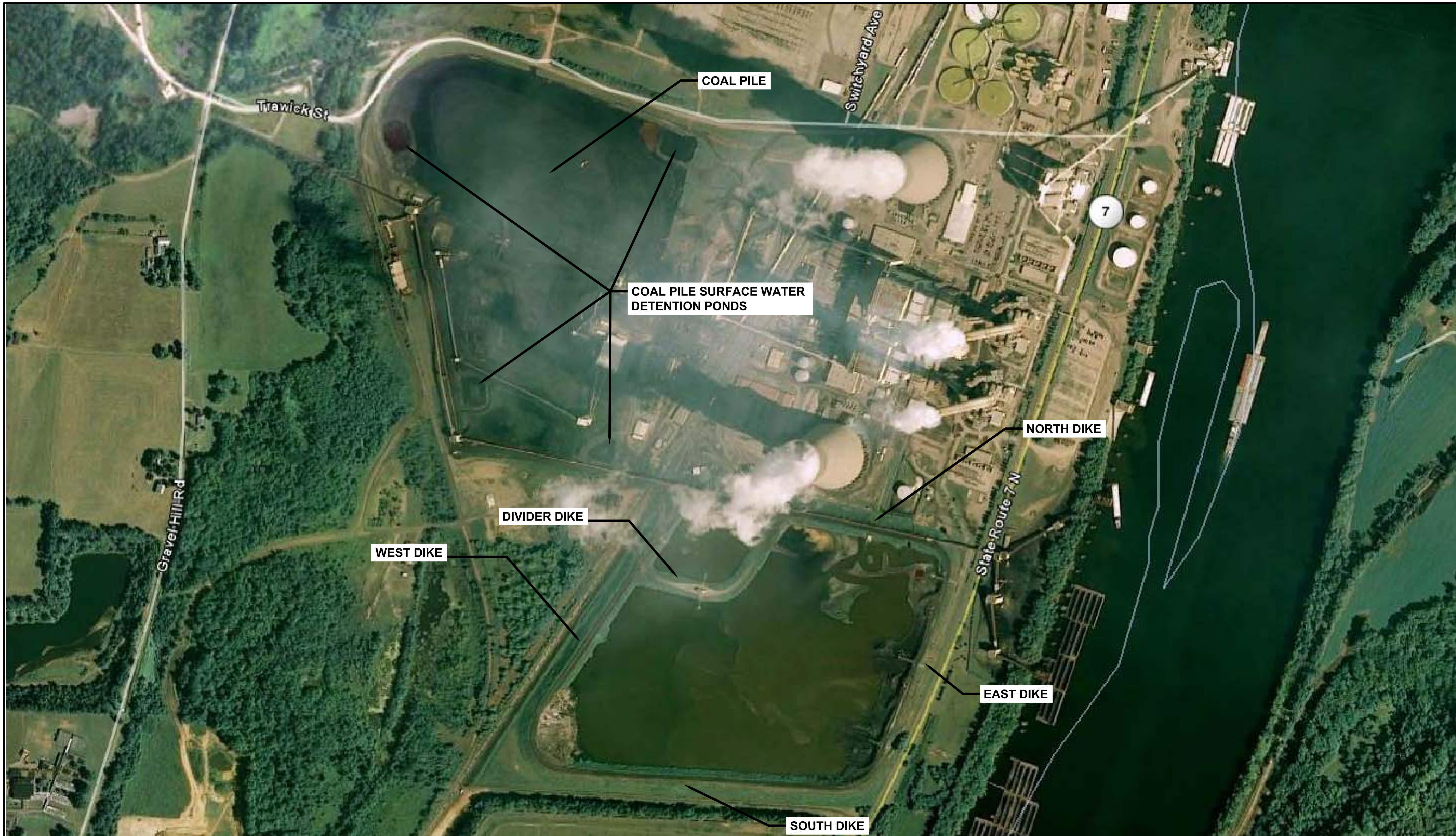
File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 4:45:05 PM User: Filkins, Rebecca

N

Drawing Copyright © 2007 CHA

CHA

SITE PLAN GENERAL JAMES GAVIN POWER PLANT AMERICAN ELECTRIC POWER CHESHIRE, OHIO	PROJECT NO. 20085.4000
	DATE: JULY 2009
	FIGURE 2A



Drawing Copyright © 2007 CHA

CHA

SITE PLAN OF BOTTOM ASH POND
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 2B

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM Plotted: 7/2/2009 4:47:22 PM User: Filkins, Rebecca

Drawing Copyright © 2007 CHA

CHA

SITE PLAN OF STINGY RUN DAM
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 2C

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 4:54:47 PM User: Filkins, Rebecca

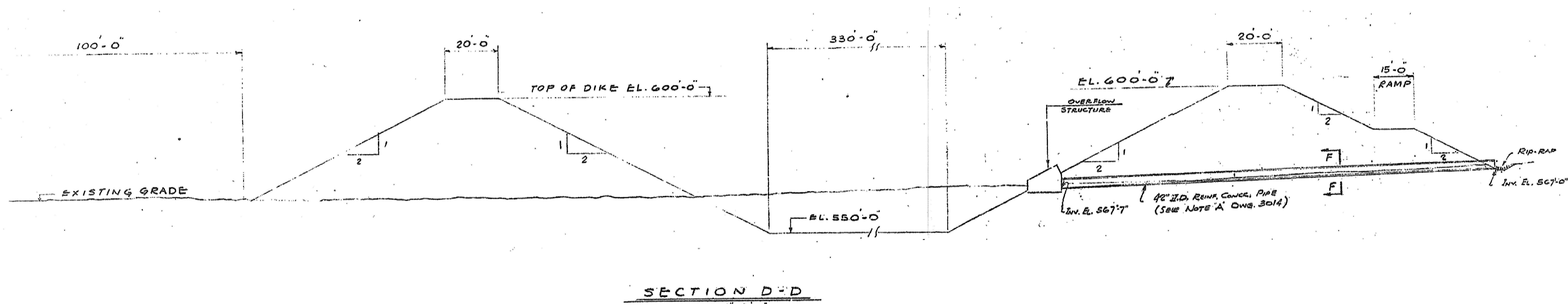


IMAGE REFERENCE: BOTTOM ASH DISPOSAL AREA SECTIONS,
DRAWING NO. 12-3015A

Drawing Copyright © 2007 CHA

CHA

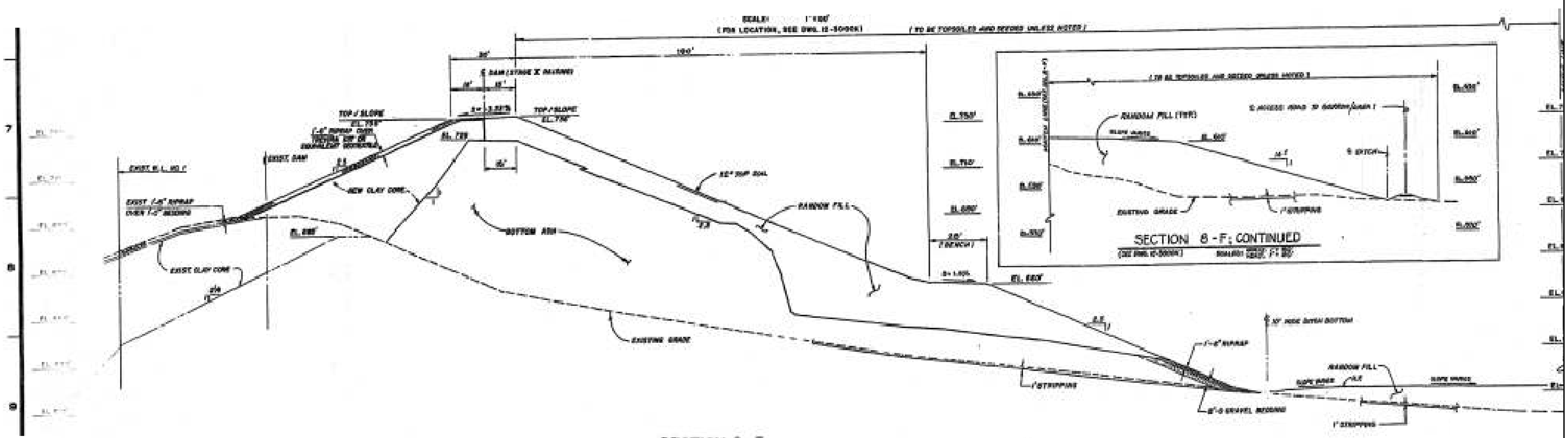
BOTTOM ASH POND TYPICAL CROSS SECTION
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 3

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 1:08:33 PM Plotted: 7/2/2009 3:18:17 PM User: Filkins, Rebecca



SECTION 8-F

IMAGE REFERENCE: STINGY RUN FLY ASH DAM
STAGE II RAISING SECTIONS & DETAILS, SHEET 1

Drawing Copyright © 2007 CHA

CHA

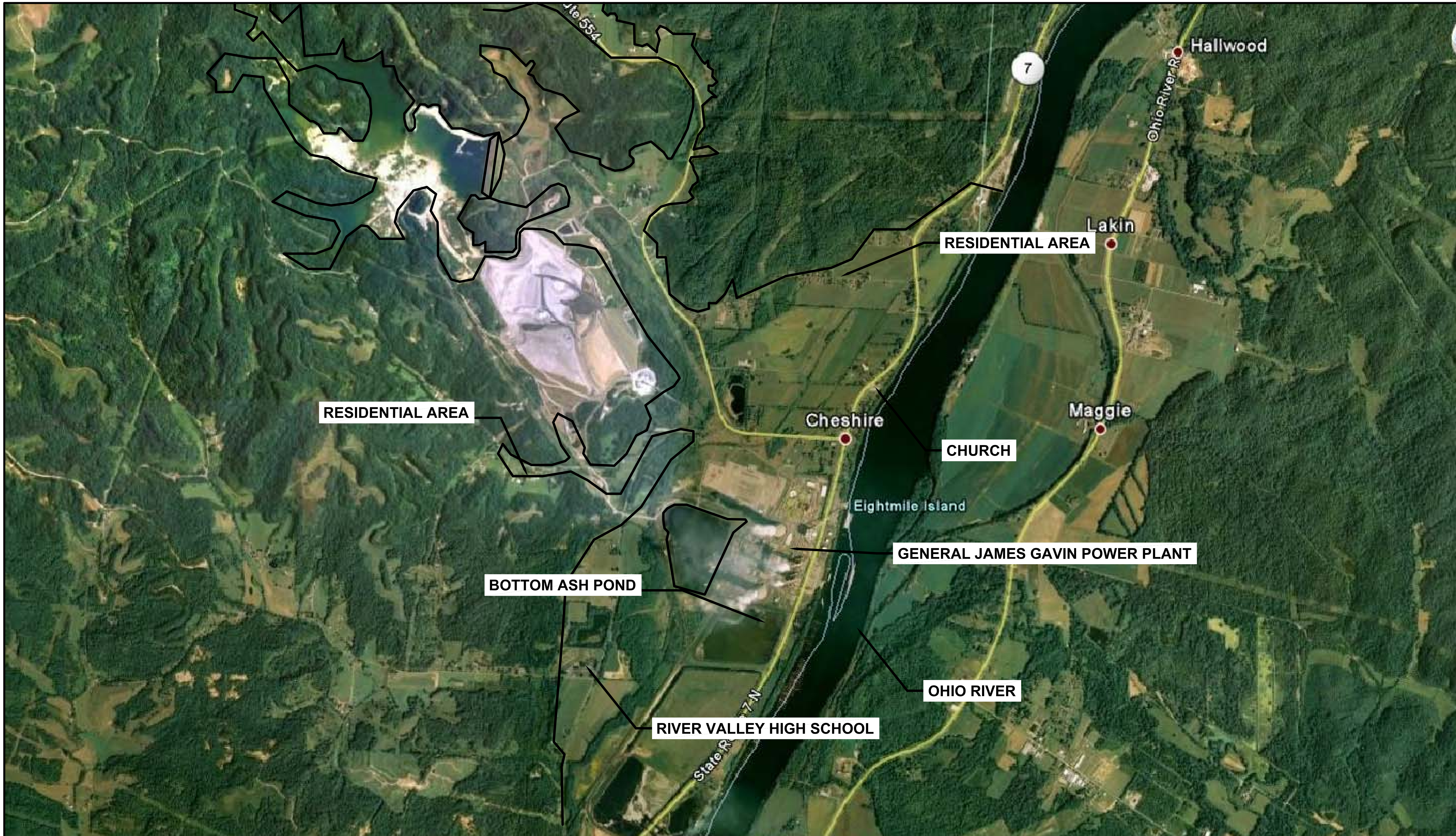
STINGY RUN DAM TYPICAL CROSS SECTION
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO.
20085.4000

DATE: JULY 2009

FIGURE 4

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 6:09:47 PM Plotted: 7/2/2009 6:35:29 PM User: Filkins, Rebecca



LEGEND

APPROXIMATE LIMIT OF DAM-BREAK OVER FLOW AREA AS SHOWN ON AEPGV 002825 FLOOD INUNDATION MAP

N

Drawing Copyright © 2007 CHA

CHA

CRITICAL INFRASTRUCTURE
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 5

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 4:56:58 PM User: Filkins, Rebecca

2.0 FIELD ASSESSMENT

2.1 Visual Observations

CHA performed visual observations of the Bottom Ash Pond and Stingy Run Dam following the general procedures and considerations contained in FEMA's *Federal Guidelines for Dam Safety* (April 2004), and FERC Part 12 Subpart D to make observations concerning settlement, movement, erosion, seepage, leakage, cracking, and deterioration. A Coal Combustion Dam Inspection Checklist Form, prepared by the US Environmental Protection Agency, was completed on-site during the site visit. A copy of the completed form was submitted via email to a Lockheed Martin representative approximately three days following the site visit to the General James Gavin Plant. A copy of this completed form is included at the end of Section 2.4. Photo logs and Site Photo Location Maps (Figures 6A and 6B) for the Bottom Ash Pond and Stingy Run Dam, respectively are also located at the end of Section 2.4.

CHA's visual observations were made on June 1, 2009 and June 2, 2009. The weather was sunny with temperatures between 50 and 90 degrees Fahrenheit. Prior to the days we made our visual observations the following approximate rainfall amounts occurred (as reported by www.weather.com).

Table 1– Approximate Precipitation Prior to Site Visit

Date of Site Visit – June 1, 2009 & June 2, 2009		
Day	**Date**	**Precipitation (inches)**
Monday	May 25, 2009	0.85
Tuesday	May 26, 2009	0.40
Wednesday	May 27, 2009	0.17
Thursday	May 28, 2009	0.36
Friday	May 29, 2009	0.00
Saturday	May 30, 2009	1.10
Sunday	May 31, 2009	0.00
Monday	June 1, 2009	0.00
Tuesday	June 2, 2009	0.17
Total	**Week Prior to Site Visit**	**2.88**
Total	**Month of May**	**7.14**

2.2 Visual Observation – Bottom Ash Pond

CHA performed visual observations of the Bottom Ash Pond dikes. The dikes in total are about 6,565 feet long and about 36 feet high. The vegetation growth was cut on the embankments immediately prior to our site visit and was completed during our site visit. Therefore, some photographs may show tall weeds. CHA was able to make observations subsequent to mowing activities.

2.2.1 Embankments and Crest

In general, the alignment of the Bottom Ash Pond dike crests do not show signs of change in their horizontal alignment. According to AEP personnel, the crest is re-graded as needed to fill in tire ruts and prevent ponding of storm water along the crest. Refer to the following photos showing the dike crest alignment:

- Photo 1 – West Dike
- Photo 15 – South Dike
- Photo 24 – East Dike
- Photo 26 – North Dike

2.2.1.1 South Dike

The crest width shown on the construction drawings was 20 to 35 feet wide. CHA measured the crest to be as wide as 40 feet. It appears that routine grading of the crest has resulted in an over-steepening of the upper portion of the embankments. The design slopes were already 2H:1V. Along the south dike, the combination of this over-steepening and wave action undercutting has resulted in surface sloughing as shown in Photos 11 through 16.

At about the mid point along the length of the south dike downstream slope, there is a wet area that has been noted in previous reports to be seepage. AEP personnel indicated that in February 2009 the storm water drainage from the field to the south of the Bottom Ash Pond was re-graded so rather than draining towards the Bottom Ash Pond, the runoff would run away from the Bottom Ash Pond. AEP indicated this appears to be largely improving the condition at the toe of the south dike. Piezometer readings indicate the groundwater table is about 18 feet below the toe of the south dike further suggesting that the observed water was perched on surface soil layers. No flow was observed in ponded water at the toe of the south dike.

Occasional trees were observed on the upstream slope at the water line.

2.2.1.2 East Dike

The upstream slope of the east dike is piled with CCW as there are three primary sluice areas along this dike; one from Unit 1, one from Unit 2, and 1 containing “pyrite” waste.

The downstream slope is tiered due to an access road that traverses from the bottom of the east dike at the north corner to the top of the east dike at the south corner. This access bench is shown in Photo 24.

There were many areas of erosion gullies along the transition from the crest to the downstream slope. The deepest of these was 18 inches deep. There was evidence that the development of these is common and that AEP routinely repairs them as part of ongoing maintenance of the dikes. Photos 22 and 23 show a typical representation of these areas on the east dike.

Along the east dike toe, several rodent holes were observed as shown in Photo 32. A few of these appeared to be plugged and AEP personnel indicated they have had to trap rodents from time to time. Some of the observed rodent holes may have been active, although it was difficult to distinguish.

There are a few tree stumps along the toe of the east dike as shown in Photo 33. AEP personnel did not know when these trees were cut or why the bench with the access road was apparently constructed around them. These stumps should be monitored for decay and the stumps and associated root balls removed as a maintenance task in the next 2 to 5 years under the direction of a professional engineer.

2.2.1.3 North Dike

Previous inspection reports had indicated that there was an area at the northeast corner where runoff from flushing dust from the coal conveyor was resulting in an erosion gully on the downstream slope. In 2008 a concrete pad and knee wall was placed under the coal conveyor at this location to minimize the impact of routine cleaning of the coal conveyor on the dike. The runoff now flows across the crest and drains to the pond.

Although not resulting in as severe an erosion feature, several other locations on the downstream slope of the north dike similarly showed runoff from flushing of the coal conveyor as shown in Photo 34 and 35.

Along the Upstream Slope of the north dike, there are a few locations where various sumps from the plant area are discharged into the Pond. Most of these discharge pipes have concrete splash pads underneath these. Sections of Conveyor Belt have been placed over these because abrasion from particles in the discharge was degrading the surface of the concrete. Because of this covering and active flow, CHA could not observe the condition around these splash pads. CHA recommends that these areas be inspected as plant operation allows (i.e. when water is not flowing across the splash pads) to evaluate the concrete condition, and make sure flows are not eroding the adjacent soil of the dike.

2.2.1.4 West Dike

Along the west dike there are several signs of previous surface erosion features. AEP has repaired these as they occur. Photo 2 shows one of these repaired areas.

Previous reports indicated there is a bulge on the downstream slope of the west dike. CHA observed this area and did not see signs of current movement, nor an area above this slope where it appears that either the bulged soil came from or that the area was repaired. AEP should continue to monitor this area for changes as they have in the past.

Occasional small trees were observed on the upstream slope at the water line, which should be removed during routine mowing activities.

2.2.2 Bottom Ash Outlet Control Structure and Discharge Channel

There are two outlet control structures in the Bottom Ash Pond. The Primary Outlet is a drop inlet structure with a concrete pipe beneath the intermediate dike. The outlet pipe was submerged and could not be observed. Photos 37, 41 and 42 show this outlet control structure.

The secondary outlet has been relocated to the north dike from the west dike. According to AEP, the intake platform on the upstream slope of the west dike in the secondary pond is still in place, but the pipe has been filled with grout and a new spirolite pipe was jacked beneath the north dike. The new pipe connects to a buried discharge pipe conveying outflow to the Ohio River. Photo 43 shows this submerged outlet. The downstream end of the outflow is buried.

2.3 Visual Observations – Stingy Run Dam

CHA performed visual observations of Stingy Run Dam. The Stingy Run Dam is about 1,800 feet long and about 144 feet high.

2.3.1 Embankments and Crest

In general, the alignment of the crest of Stingy Run Dam does not show signs of change in horizontal alignment. This alignment arches slightly in the upstream direction. Both the north and south abutments have large bedrock outcrops (Photos 50 and 51).

The upstream slope is armored with 8-inch diameter rip rap, which extend below the current reservoir water level (Photo 63).

The toe drain is armored with 6-inch diameter rip rap (Photo 49). This rip rap extends about 45 feet up the slope, and ends at the drainage swale at the toe. This drainage swale has 3 operating V-notch weirs (Photos 48 and 54). AEP personnel reported that during dry spells the flow in this swale reduces significantly although portions of the swale show vegetative signs of being perennially wet (Photo 52). During our visit, about 1.8 gallons per minute was flowing through the most downstream weir based on field measured weir geometry. A sample was taken from this weir, and appeared clear. Flow in the upstream portions of the swale also appeared clear. The depth of flow over each of these three weirs is measured and recorded by AEP personnel quarterly.

2.3.2 Stingy Run Dam Outlet Control Structure

The Intake Tower in Stingy Run Dam was inaccessible at the time of our visit. The floating access bridge to the tower is severely deteriorated and AEP blocked it off in 2008. Photos 65 and 66 show the tower and access bridge.

2.3.3 Stingy Run Dam Discharge Channel

Stingy Run discharges through a concrete and metal weir structure as shown in Photo 47. From this point the flow enters the natural stream channel of Stingy Run.

2.3.4 Stingy Run Abandoned Emergency Spillway

To the south of the dam there is an area that was formerly in place to act as an emergency spillway. The dam was raised in 1988 but the water level was never raised to the full height planned and the reservoir is no longer used for fly ash disposal so the water level is not expected to change. AEP has constructed a landfill immediately downstream of the original emergency spillway and confirmed that this would not be needed for design storm passage based on the current water level operations. Photos 70 through 72 show this abandoned emergency spillway. A more complete discussion on this is included in Section 3.3.2.

2.4 Monitoring Instrumentation

There is monitoring instrumentation installed at both the Bottom Ash Pond and Stingy Run Dam. Figure 7A shows the approximate locations of instrumentation at the Bottom Ash Pond, and Figure 7B shows the approximate locations of instrumentation at Stingy Run Dam.

The Bottom Ash Pond is monitored with piezometers. Two "old" piezometers, BAP-1 and BAP-2, are in place at the toe of the west and south dikes, respectively. These piezometers have been monitored for many years although the installation date of these is unknown. Four additional piezometers were installed as part of a recent evaluation of the Bottom Ash Pond initiated by AEP following the TVA incident. Piezometers GV-PZ-BAP-901 through GV-PZ-BAP-904 were installed at the crest and toe of the west and south dikes as shown in Figure 7A.

At Stingy Run Dam many piezometers, settlement monitoring monuments, and inclinometers are in place as shown in Figure 7B. The locations shown in Figure 7B represent what was provided to CHA although AEP acknowledged that some of these locations have been destroyed over the years by mowers and vandals. Therefore, this figure should not be considered an accurate depiction of currently operating instrumentation.

A more complete discussion of the data collected from this instrumentation is contained in Section 3.4.

Site Name: General James Gavin Steam Plant	Date: June 1, 2009
Unit Name: Gavin Bottom Ash Pond	Operator's Name: Ohio AEP
Unit I.D.:	Hazard Potential Classification: High Significant Low
Inspector's Name: Katherine Adnams/Malcolm D. Hargraves	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	quarterly		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	578		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	n/a		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	n/a		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	590		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	n/a	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	n/a		From underdrain?	n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?		x
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?		x
12. Are decant trashracks clear and in place?	x		From downstream foundation area?		x
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		x	"Boils" beneath stream or ponded water?		x
14. Clogged spillways, groin or diversion ditches?		x	Around the outside of the decant pipe?		x
15. Are spillway or ditch linings deteriorated?	not	seen	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		x	23. Water against downstream toe?		x
17. Cracks or scarps on slopes?	x		24. Were Photos taken during the dam inspection?	x	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
	Note that the Ohio DNR Div. of Water established the Potential Classification classification prior to the site visit and based on health hazards.
1	Ohio AEP makes quarterly to annual inspections of the embankment; periodic measurements of monitoring wells are also made and recorded.
14,15	The spillways/outlets servicing the bottom ash pond and reclaim pond cannot be observed directly because they are submerged. They appear to function as designed - there is no visible clogging effect
17,18,19	Observed scarps, sloughs, and erosional features are superficial, due to routine grading activities.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0028762 INSPECTOR Adnams/Hargraves

Date June 1, 2009

Impoundment Name Gavin Bottom Ash Pond

Impoundment Company Ohio Power Company

EPA Region 5

State Agency (Field Office) Addresss Ohio EPA Southeast District Office
2195 Front Street; Logan, Ohio 43138-8687

Name of Impoundment Gavin Bottom Ash Pond

(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update x

	Yes	No
Is impoundment currently under construction?		x
Is water or ccw currently being pumped into the impoundment?	x	

IMPOUNDMENT FUNCTION: Bottom Ash, Pyrite, "Blowdown", Chemical Washdown Waste

Nearest Downstream Town : Name Addison, Ohio

Distance from the impoundment 3 miles

Impoundment Location:

Longitude 82	Degrees	7	Minutes	15	Seconds
Latitude 38	Degrees	55	Minutes	50	Seconds
State Ohio	County Gallia				

Does a state agency regulate this impoundment? YES x NO ______

If So Which State Agency? ODNR-Division of Water

<u>HAZARD POTENTIAL</u> (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

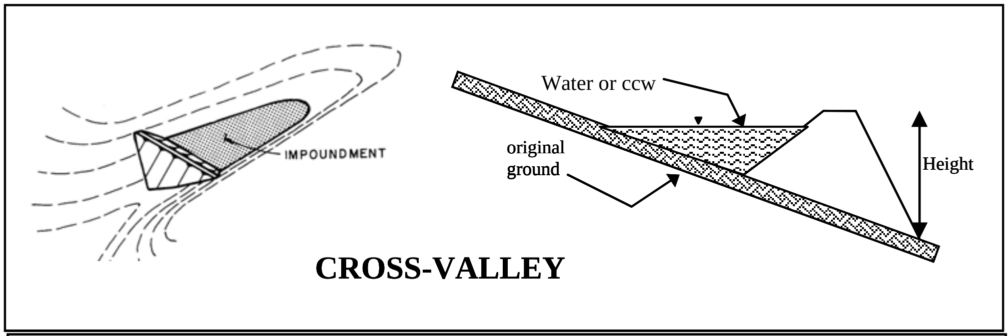
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

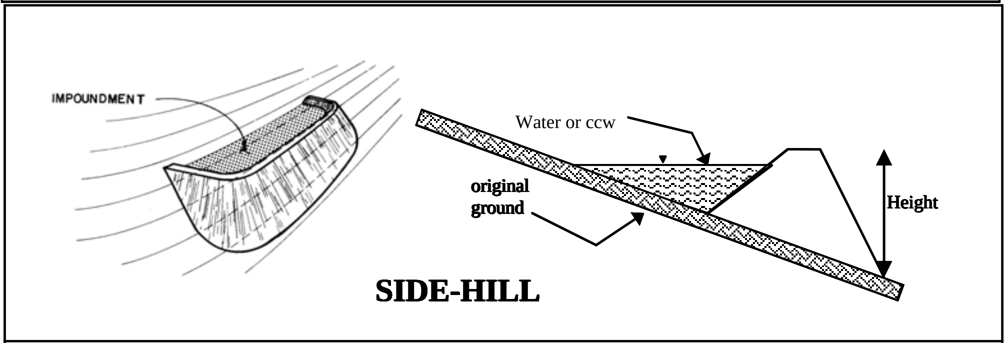
x______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

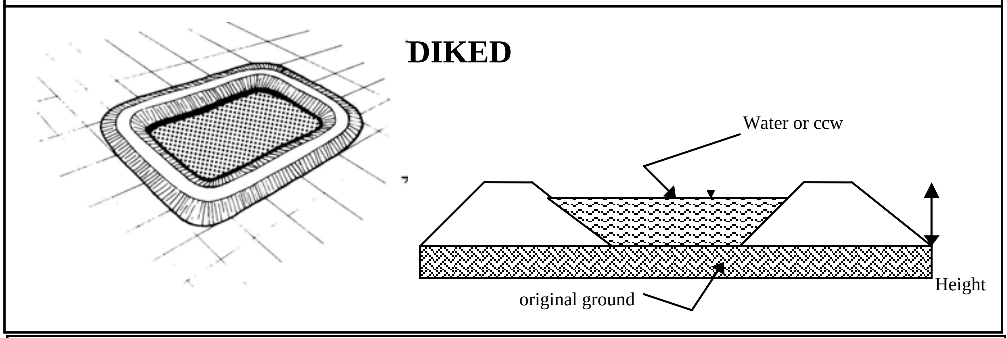
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

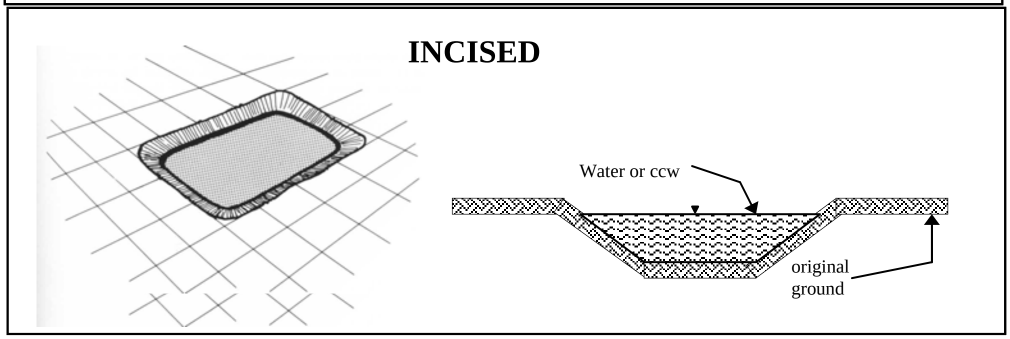
In the event of a failure under full pool at elevation 590, the waste would inundate the Gavin Plant facilities to the north and Ohio Route 7 to the east, potentially endangering Gavin plant employees and vehicular traffic. Given the close proximity of the Ohio River, a potential breach wave could push waste and vehicular traffic into the river.

CONFIGURATION:









_____ Cross-Valley
_____ Side-Hill
x_____ Diked
_____ Incised (form completion optional)
_____ Combination Incised/Diked

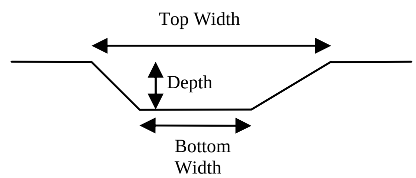
Embankment Height 36 feet Embankment Material Native Borrow
Pool Area 85 acres Liner none
Current Freeboard approx. 12 feet Liner Permeability n/a

TYPE OF OUTLET (Mark all that apply)

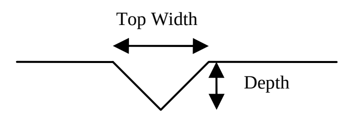
n/a **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width

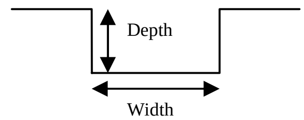
TRAPEZOIDAL



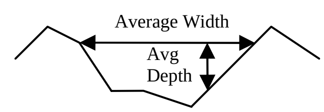
TRIANGULAR



RECTANGULAR

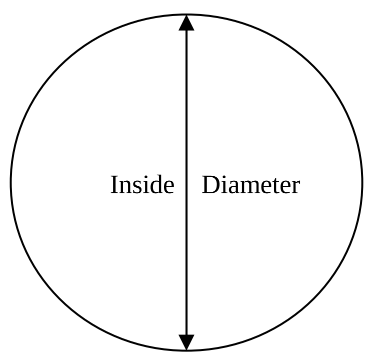


IRREGULAR



x **Outlet**

42, 30 inside diameter



Material
______ corrugated metal
______ welded steel
x concrete
x plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

Is water flowing through the outlet? YES x NO _______

______ **No Outlet**

______ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By Ohio AEP with Casagrande Consltants

Has there ever been a failure at this site? YES ___________ NO x___________

If So When? n/a____________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO x_______

If So When? ___________________________

IF So Please Describe: ____

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO x________

If so, which method (e.g., piezometers, gw pumping,...)? piezometers (see below)

If so Please Describe :

There have been monitoring wells/piezometers installed at different times (most recently in April) as a part of a proactive monitoring and maintenance program. Water level measurements have been and continue to be recorded periodically at these locations. In addition, AEP has initiated a proactive soil boring and testing program as part of a stability analysis study for the bottom ash pond impoundment.

Site Name: General James Gavin Steam Plant	Date: June 1, 2009
Unit Name: Gavin Bottom Ash Pond	Operator's Name: Ohio AEP
Unit I.D.:	Hazard Potential Classification: High Significant Low
Inspector's Name: Katherine Adnams/Malcolm D. Hargraves	

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No		Yes	No
1. Frequency of Company's Dam Inspections?	quarterly		18. Sloughing or bulging on slopes?	x	
2. Pool elevation (operator records)?	578		19. Major erosion or slope deterioration?		x
3. Decant inlet elevation (operator records)?	n/a		20. Decant Pipes:		
4. Open channel spillway elevation (operator records)?	n/a		Is water entering inlet, but not exiting outlet?		x
5. Lowest dam crest elevation (operator records)?	590		Is water exiting outlet, but not entering inlet?		x
6. If instrumentation is present, are readings recorded (operator records)?	x		Is water exiting outlet flowing clear?	n/a	
7. Is the embankment currently under construction?		x	21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	n/a		From underdrain?	n/a	
9. Trees growing on embankment? (If so, indicate largest diameter below)		x	At isolated points on embankment slopes?		x
10. Cracks or scarps on crest?		x	At natural hillside in the embankment area?	n/a	
11. Is there significant settlement along the crest?		x	Over widespread areas?		x
12. Are decant trashracks clear and in place?	x		From downstream foundation area?		x
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		x	"Boils" beneath stream or ponded water?		x
14. Clogged spillways, groin or diversion ditches?		x	Around the outside of the decant pipe?		x
15. Are spillway or ditch linings deteriorated?	not	seen	22. Surface movements in valley bottom or on hillside?		x
16. Are outlets of decant or underdrains blocked?		x	23. Water against downstream toe?		x
17. Cracks or scarps on slopes?	x		24. Were Photos taken during the dam inspection?	x	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue #	Comments
	Note that the Ohio DNR Div. of Water established the Potential Classification classification prior to the site visit and based on health hazards.
1	Ohio AEP makes quarterly to annual inspections of the embankment; periodic measurements of monitoring wells are also made and recorded.
14,15	The spillways/outlets servicing the bottom ash pond and reclaim pond cannot be observed directly because they are submerged. They appear to function as designed - there is no visible clogging effect
17,18,19	Observed scarps, sloughs, and erosional features are superficial, due to routine grading activities.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # OH0028762 INSPECTOR Adnams/Hargraves
Date June 1, 2009

Impoundment Name Gavin Bottom Ash Pond
Impoundment Company Ohio Power Company
EPA Region 5
State Agency (Field Office) Addresss Ohio EPA Southeast District Office
2195 Front Street; Logan, Ohio 43138-8687
Name of Impoundment Gavin Bottom Ash Pond
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update x

	Yes	No
Is impoundment currently under construction?		x
Is water or ccw currently being pumped into the impoundment?	x	

IMPOUNDMENT FUNCTION: Bottom Ash, Pyrite, "Blowdown", Chemical Washdown Waste

Nearest Downstream Town : Name Addison, Ohio
Distance from the impoundment 3 miles
Impoundment
Location: Longitude 82 Degrees 7 Minutes 15 Seconds
Latitude 38 Degrees 55 Minutes 50 Seconds
State Ohio County Gallia

Does a state agency regulate this impoundment? YES x NO ______

If So Which State Agency? ODNR-Division of Water

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

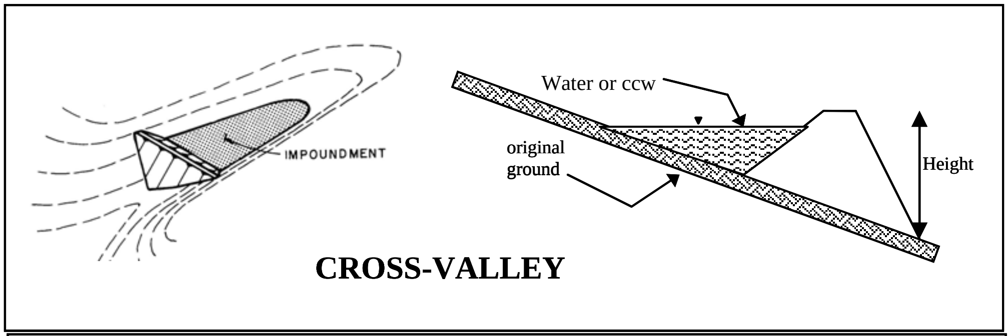
______ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

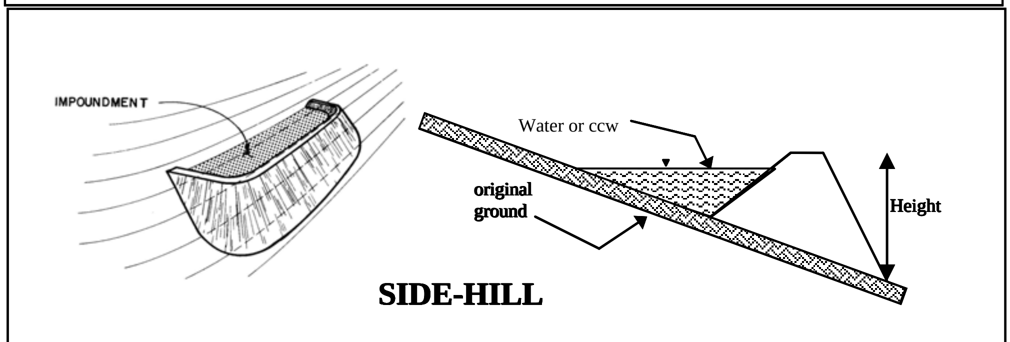
x_____ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

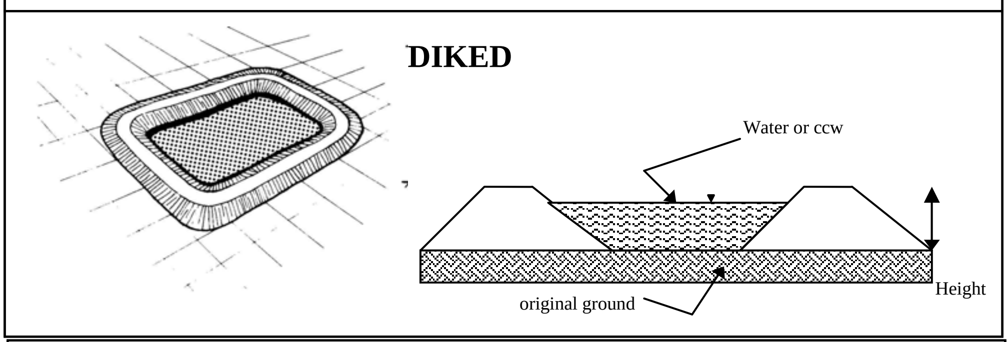
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

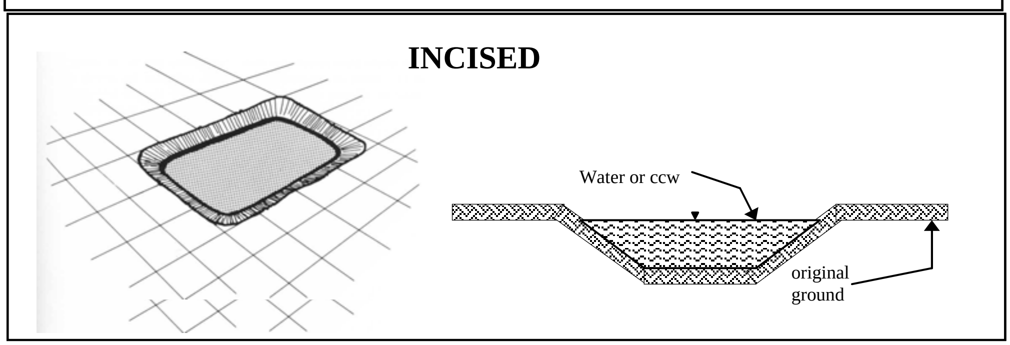
In the event of a failure under full pool at elevation 590, the waste would inundate the Gavin Plant facilities to the north and Ohio Route 7 to the east, potentially endangering Gavin plant employees and vehicular traffic. Given the close proximity of the Ohio River, a potential breach wave could push waste and vehicular traffic into the river.

CONFIGURATION:









______ Cross-Valley
______ Side-Hill
x_____ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

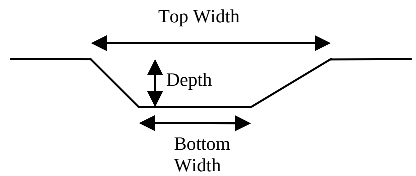
Embankment Height 36 feet Embankment Material Native Borrow
Pool Area 85 acres Liner none
Current Freeboard approx. 12 feet Liner Permeability n/a

TYPE OF OUTLET (Mark all that apply)

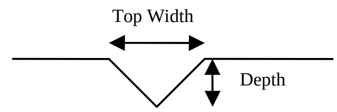
n/a___ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width

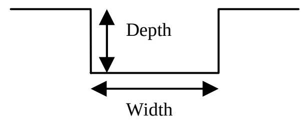
TRAPEZOIDAL



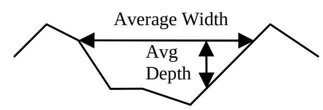
TRIANGULAR



RECTANGULAR

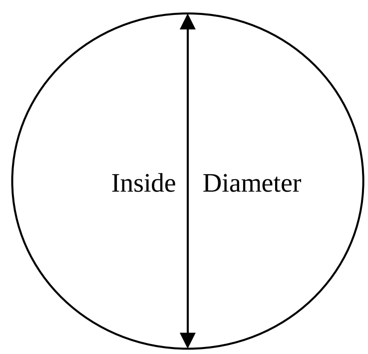


IRREGULAR



x_____ **Outlet**

42, 30 inside diameter



Material
______ corrugated metal
______ welded steel
x_____ concrete
x_____ plastic (hdpe, pvc, etc.)
______ other (specify) ______________________

Is water flowing through the outlet? YES x_______ NO _______

______ **No Outlet**

______ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By Ohio AEP with Casagrande Consltants
____

Has there ever been a failure at this site? YES __________ NO x__________

If So When? n/a__________________________

If So Please Describe : ____

Has there ever been significant seepages at this site? YES _______ NO x_______

If So When? ___________________________

IF So Please Describe: ____

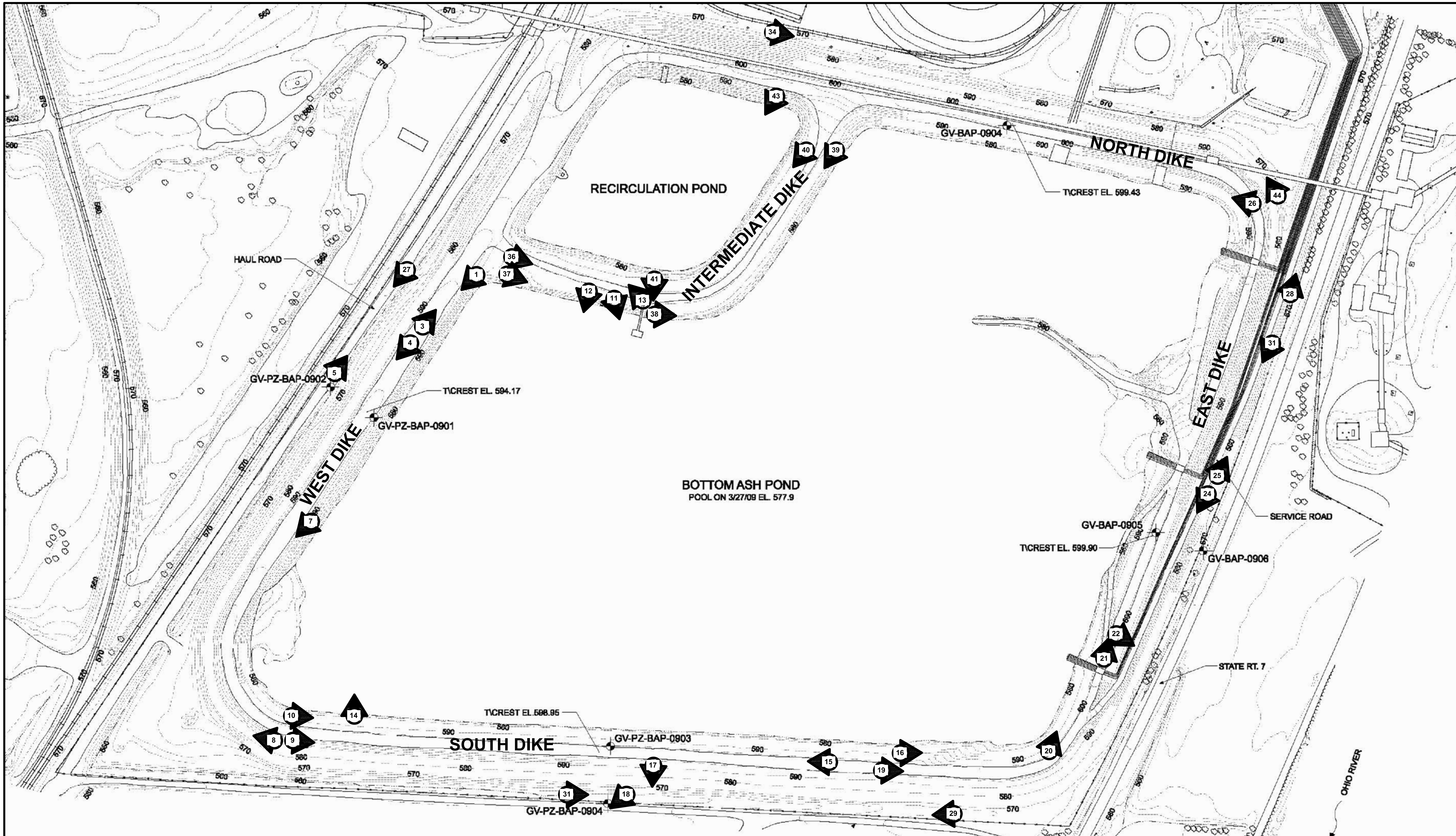


IMAGE REFERENCE: BOTTOM ASH POND INVESTIGATION,
PLAN OF BORINGS

Drawing Copyright © 2007 CHA

CHA

BOTTOM ASH POND PHOTO LOCATIONS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000	
DATE: JULY 2009	
FIGURE 6A	

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 5:11:42 PM User: Filkins, Rebecca

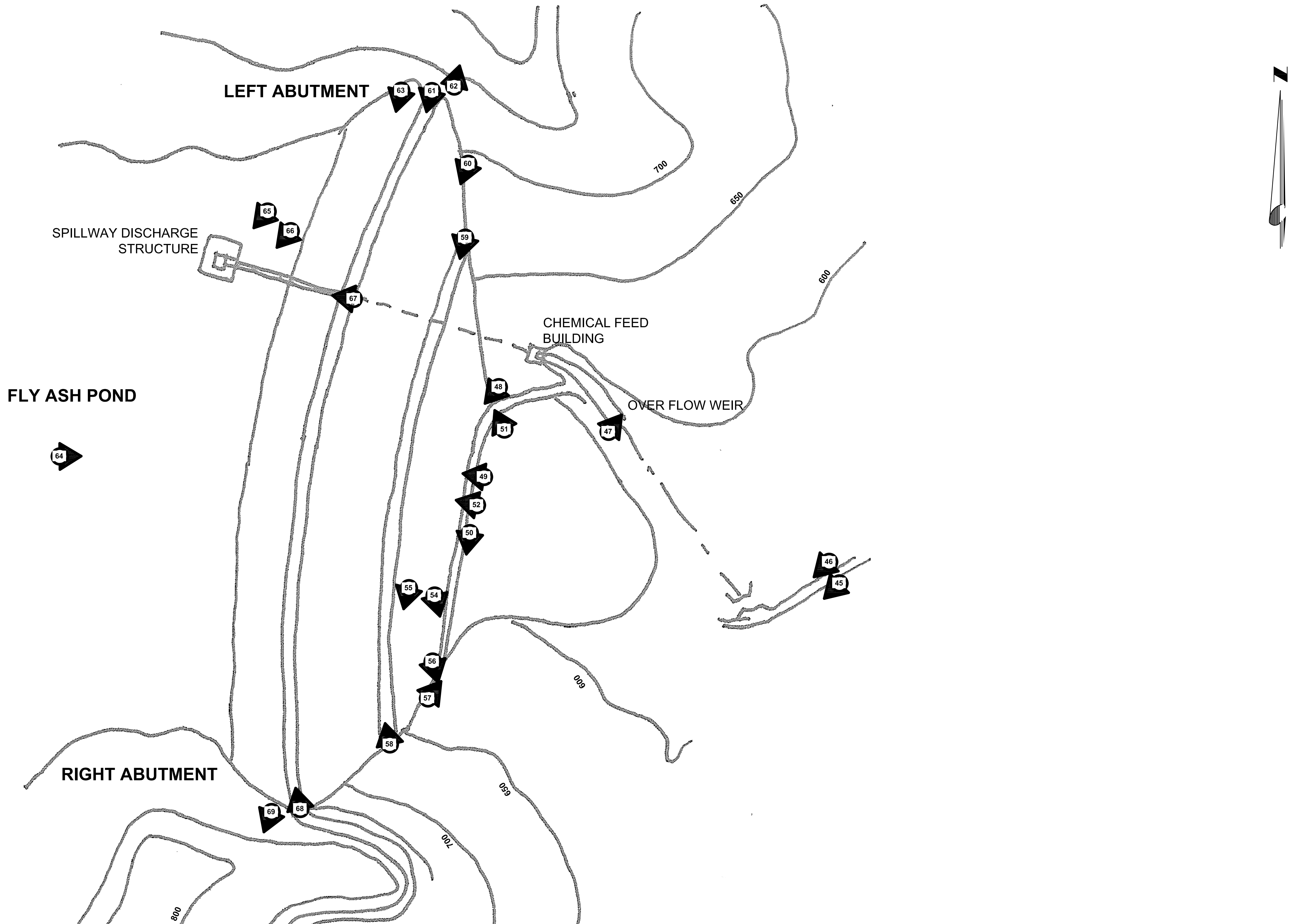


IMAGE REFERENCE: STINGY RUN FLY ASH DAME INSPECTION LOCATION PLAN, AEPGV00305

Drawing Copyright © 2007 CHA

CHA

STINGY RUN DAM PHOTO LOCATIONS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 6B

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 5:24:10 PM User: Filkins, Rebecca

1

Upstream slope of the west dike, looking south.

2

Erosion feature filling on the upstream slope of the west dike.

CHA	AMERICAN ELECTRIC POWER GEN. JAMES GAVIN POWER PLANT BOTTOM ASH POND CHESHIRE, OH
CHA Project No.: 20085.4000.1510	June 2, 2009

3

Downstream slope of the west dike, looking north.

4

Downstream slope of the west dike, looking south. Note that weed-whacking was in progress and is reportedly performed twice a year.

5

Downstream toe of the west dike, looking north.

6

Standing water in drainage swale at toe of west dike. Appears related to surface water runoff. Piezometer readings confirm groundwater is well below the ground surface.

7

Southwest corner of the bottom ash pond. Area used for trucked in bottom ash from various cleaning operations.

8

Downstream slope at southwest corner, looking west.   Note that weed-whacking was in progress and is reportedly performed twice a year.

9

Downstream slope of the south berm, looking east. Note that weed-whacking was in progress and is reportedly performed twice a year.

10

Upstream slope of the south dike, looking east.

11

Upstream slope of the south dike, looking south. Note surficial sloughing.

12

Upstream slope of the south dike, looking south. Note surficial sloughing.

13

Upstream slope of the south dike, looking south. Note surficial sloughing.

14

Close up of suficial slough on the upstream slope of the south dike, looking west.

15

Upstream slope of the south dike, looking west.

16

Upstream slope of the south dike, looking east.

17

Downstream slope of the south dike about mid-slope. Note cattails growing at the toe of the slope. This area has been reportedly a wet area, but AEP believes it is related to surface drainage and in the fall 2008 reset culverts crossing the adjacent access road to pitch away from the wet area and the conditions appears to be improving. Recent spring rains have resulted in standing water in this area.

18

Downstream slope of the south dike. Note one of the re-set culverts at the fence line.

19

South end of the east dike. Bottom ash sluicing area.

20

East end of the bottom ash pond. Bottom ash sluicing performed throughout this slope area.

21

Ash disposal along upstream slope of east dike, looking north.

22

Surface erosion features (typical) along graded ash at east dike upstream slope/crest transition.

23

Surface erosion features (typical) along graded ash at east dike upstream slope/crest transition.

24

Crest and downstream slope alignment of east dike looking south.
Note east dike is benched to allow an access road and sluice pipe placement.

25

Crest and downstream slope alignment of east dike, looking north. Crest is raised at sluice pipe crossings.

26

Crest and upstream slope alignment of north dike, looking west. Coal conveyor runs the length of the north dike crest.

27

Apparent bulge reported in previous reports along west dike. No signs of current movement.

28

North end of east dike, looking north. This portion of the downstream slope is part of the benched out area for the access road.

29

Downstream slope of south dike, looking west.

30

Downstream slope of south dike, looking east. Tractor ruts are in wet area at the toe where drainage backs up. This has been previously reported as a seepage area. Recent regrading to improve surface runoff appears to have dried this area and piezometer readings indicate the water table is below the toe of the dike.

CHA	**AMERICAN ELECTRIC POWER** **GEN. JAMES GAVIN POWER PLANT** **BOTTOM ASH POND** **CHESHIRE, OH**
CHA Project No.: 20085.4000.1510	June 2, 2009

31

Downstream slope of east dike, looking south.

32

Several rodent holes were noted on the downstream slope of the east dike. Some were plugged from previous AEP efforts to deter rodents and repair holes. Others were unidentifiable as active or abandoned holes.

33

Several tree stumps noted on the downstream slope of the east dike (others except this one were cut flush to ground surface). This is in the benched out area of the east dike.

34

Downstream slope of north dike, looking east. Note dark areas in the grass on the slope are coal residue runoff from flushing the coal conveyor to remove dust buildup.

35

Close-up of one area of coal residue from coal conveyor flushing.

36

South intermediate dike separating primary from secondary ponds, looking east.

37

South intermediate dike separating primary from secondary ponds, looking east.

38

Intermediate dike, looking east.

39

East intermediate dike separating primary from secondary ponds, looking south.

40

East intermediate dike separating primary from secondary ponds, looking south.

41

Main intake from primary pond to secondary pond.

42

Main intake from primary pond to secondary pond.

43

Outlet from secondary pond.

44

In 2008 a concrete pad and knee wall was placed under the coal conveyor at this location to minimize the impact of routine cleaning of the coal conveyor on the dike. The runoff now flows across the crest and drains to the pond.

45

Right (south) side of Stingy Creek Dam as seen from downstream.

46

Left (north) side of Stingy Creek Dam as seen from downstream.

47

Outlet flow from the intake tower within the reservoir.

48

Drainage swale along toe of dam. Note monitoring weir structures. Much of the flow observed here was reportedly from recent rainfall runoff.

49

Toe drain covered with 6-inch diameter rip rap.

50

Right (south) downstream abutment contact.

51

Left (north) downstream abutment contact.

52

Toe drain area shows vegetative signs of being perennially wet.

53

Vegetative growth within toe drain rip rap.

54

Close-up of Weir 3 near right (south) abutment/toe contact. Note significant difference in flow here compared to that shown in Photo (4) where all toe and groin flow for the whole length of the dam cumulates and discharges at Weir 1.

55

Close-up of Weir 3. Note the week prior to CHA's visit the site received approximately 2.9 inches of rain.

56

Abandoned weir structure located upstream of Weir 3 (appears weir plate was chipped out of the concrete). AEP staff was not aware when this was abandoned.

57

View of the dam toe looking north from the south abutment.

58

View along the bench on the downstream slope looking north.
Note survey monitoring points, monitoring wells, and inclinometers.

59

View along the bench on the downstream slope looking south.

60

Downstream slope looking south (taken from north abutment).

61

Dam crest from left (south) Abutment. Note area of tire ruts appears to be from wet area resulting from runoff from the abutment.

62

Left (north) abutment.

63

Upstream slope covered with 8-inch diameter rip rap.

64

Upstream slope of the dam.

65

The intake tower was inaccessible due to recent (spring 2009) closing of floating access bridge due to safety concerns.

66

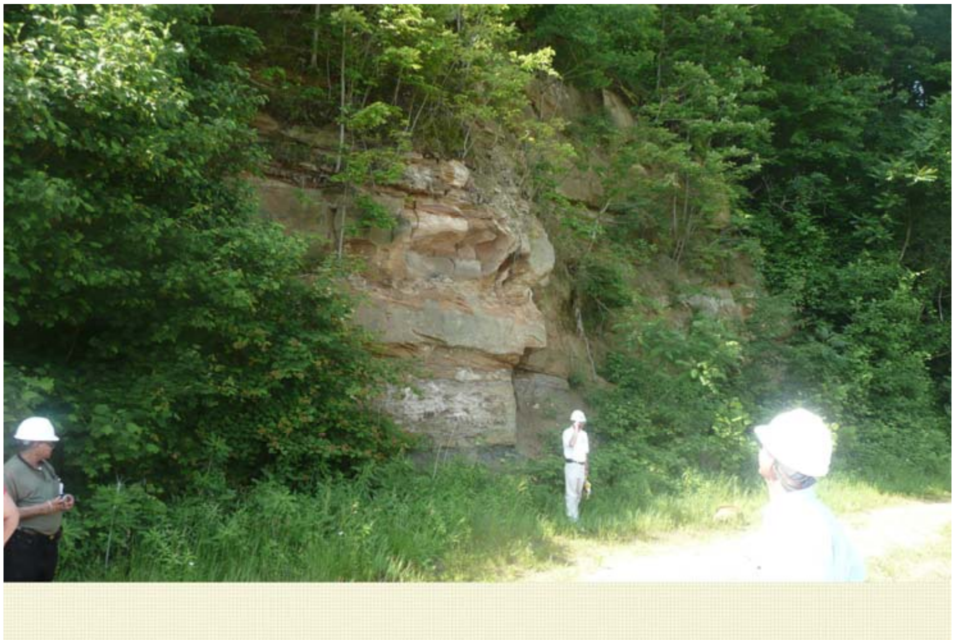
Floating Bridge to Intake Tower. Note the deteriorated condition of this structure resulted in AEP closing it in the spring of 2009.

67

Intake tower from the dam crest (looking west).

68

Dam crest and downstream slope from the right (south) abutment looking north.

69 

Right (south) abutment.

70 

Left abutment of abandoned emergency spillway. Note landfill in right of photo.

71

Right abutment of abandoned emergency spillway. Note landfill in left of photo.

72

Abandoned emergency spillway looking toward reservoir.

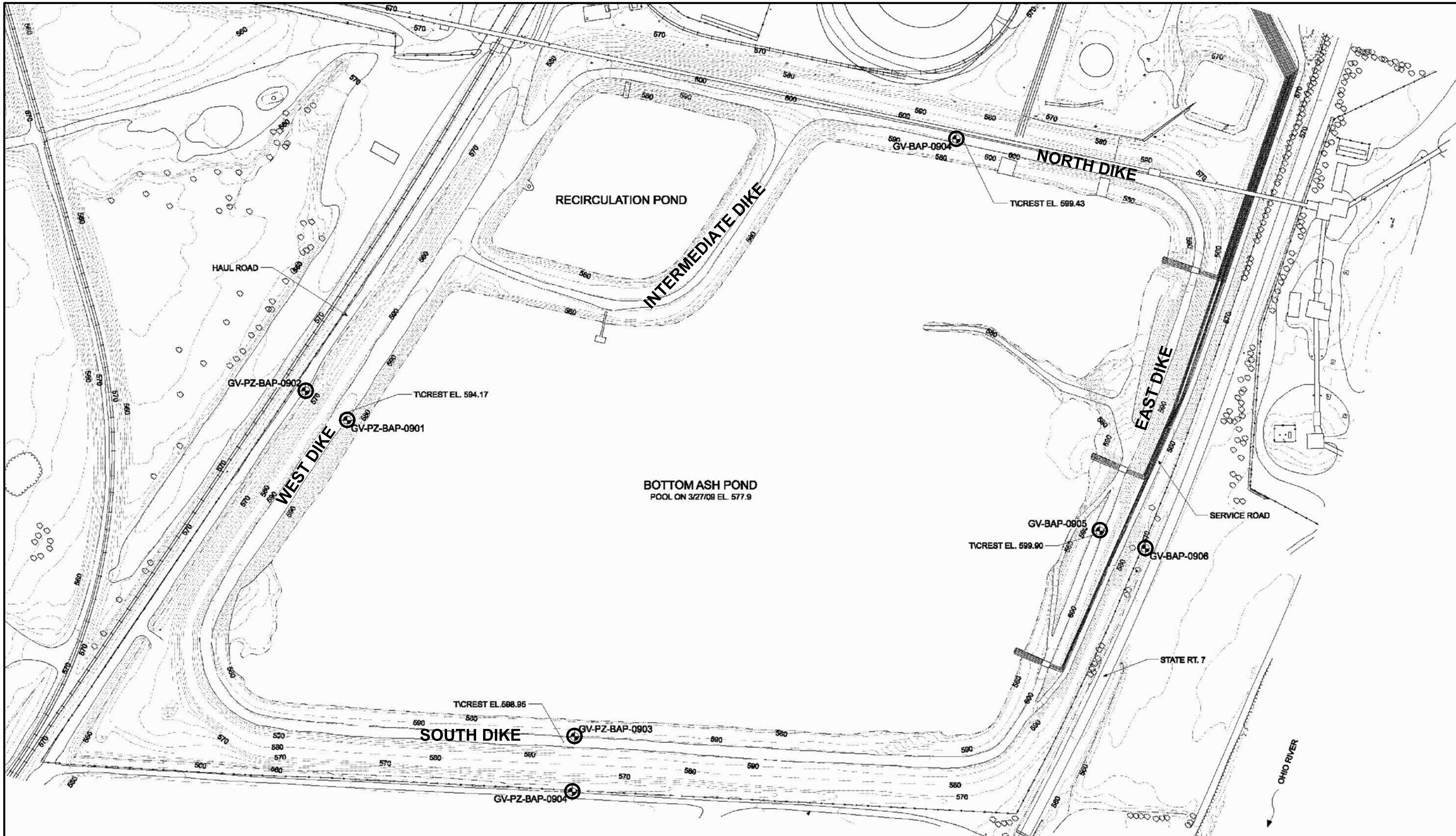


IMAGE REFERENCE: BOTTOM ASH POND INVESTIGATION, PLAN OF BORINGS

NOTE: BORINGS LABELED GV-PZ-BAP HAD PIEZOMETERS INSTALLED IN THEM.
BORINGS LABELED GV-BAP DID NOT HAVE PIEZOMETERS INSTALLED.

LEGEND

570 — EXISTING GRADE CONTOUR (2 FT. INTERVAL)
EXISTING WATER SURFACE (AT TIME OF SURVEY)
FENCE LINE
EXISTING VEGETATION
GV-PZ-BAP-0901 — BORING NUMBER AND LOCATION

N

Drawing Copyright © 2007 CHA

CHA

BOTTOM ASH POND PIEZOMETER LOCATIONS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELETRIC POWER
CHESCHIRE, OHIO

PROJECT NO. 20085.4000
DATE: JULY 2009
FIGURE 7A

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 5:35:14 PM User: Filkins, Rebecca

IMAGE REFERENCE: STINGY RUN FLY ASH DAME
INSPECTION LOCATION PLAN, AEPGV00305

Drawing Copyright © 2007 CHA

CHA

STINGY RUN DAM INSTRUMENT LOCATIONS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000	
DATE: JULY 2009	
FIGURE 7B	

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN PLANS-MAPS.DWG Saved: 7/2/2009 12:01:05 PM PLotted: 7/2/2009 5:39:23 PM User: Filkins, Rebecca

3.0 DATA EVALUATION

3.1 Design Assumptions

CHA has reviewed the design assumptions related to the design and analysis of the stability and hydraulic adequacy of the Bottom Ash Pond and Stingy Run Dam, which were available at the time of our site visits and provided to us by AEP. The design assumptions are listed in the following sections.

3.2 Hydrologic and Hydraulic Design

3.2.1 Hydrologic and Hydraulic Design – Bottom Ash Pond

The Bottom Ash Pond is classified as a Class 1 dam based on the Ohio Revised Code Chapter 1521 and Administrative Rules Chapter 1501:21 as indicated in the Division of Water Permit No. 87-159 dated February 19, 1987. This classification requires the dam to safely pass or store the inflow from the Probable Maximum Precipitation (PMP). This classification and design flood is still applicable based upon our review of Chapter 1501:21 as published at http://codes.ohio.gov/oac. This Chapter also requires a minimum freeboard of 5 feet above maximum operating pool.

AEP was not able to provide CHA with a hydraulic analysis showing the Bottom Ash Pond's ability to safely pass the PMP. However, preliminary analyses performed by CHA suggest there is enough storage capacity at the current operating pool to safely withstand this rainfall event. We recommend AEP perform a complete study to confirm this, and update the study if operating levels of the pond change in the future.

3.2.2 Hydrologic and Hydraulic Design – Stingy Run Dam

The Stingy Run Dam is classified as a Class 1 dam based on the Ohio Revised Code Chapter 1521 and Administrative Rules Chapter 1501:21 as indicated in the Division of Water Permit No. 87-159 dated February 19, 1987. This classification requires the dam to safely pass or store the inflow from the Probable Maximum Precipitation (PMP). This classification and design flood is still applicable based upon our review of Chapter 1501:21 as published at http://codes.ohio.gov/oac. This Chapter also requires a minimum freeboard of 5 feet above maximum operating pool.

The dam, as raised in 1988, included the following design assumptions as compared with the current operating parameters that were used to request a permit variance by AEP in 1997.

Table 2 - Comparison of Design Assumptions

Condition	1988 Permit (Based on 6-hr PMP)	Current Operation (Based on 24-hr PMP)
Normal Pool	726 feet	698 feet
Dam Crest	735 feet	735 feet (Permitted for lowering to 715 feet)
PMP Max Pool	731 feet	709.5 feet (with operating primary spillway) 711.6 feet (with clogged primary spillway condition)

Based on our visual observations, the current normal pool behind Stingy Run Dam appears to be approximately equal to the proposed operating pool of 698 as noted in the 1997 variance request.

The hydrologic and hydraulic evaluations were prepared by AEP engineers, peer reviewed for AEP by an outside consultant, and the resulting analyses were reviewed by OH DNR engineers. Based on the design report and permit variance request reviewed by CHA, and our observation that recent aerial mapping does not show development within the drainage basin that could change inflow characteristics during the design storm, it appears that the Stingy Run Dam will fully store the PMP.

3.3 Structural Adequacy & Stability

The Ohio Department of Natural Resources, Division of Water, Dam Safety Program recognizes "design procedures that have been established by the United States Army Corps of Engineers, the United States Department of Interior, Interior Bureau of Reclamation, the Federal Energy Regulatory Commission, The United States Natural Resources Conservation Service, and others that are generally accepted as sound engineering practice, will be acceptable to the Chief."

In performing an evaluation of the structural adequacy and stability of the Bottom Ash Pond and Stingy Run Dam, CHA has compared the computed factor of safety provided in the BBCM Engineering, Inc. report dated June 2009 and additional stability models prepared by CHA with minimum required factors of safety as outlined by the U.S. Army Corps of Engineers in EM 1110-2-1902, Table 3-1. The guidance values for minimum factor of safety are provided in Table 3.

Table 3 - Minimum Safety Factors Required

Load Case	Required Minimum Factor of Safety
Steady State Conditions at Present Pool or Flood Elevation	1.5
Rapid Draw-Down Conditions from Present Pool Elevation	1.3
Maximum Surcharge Pool (Flood) Condition	1.4
Seismic Conditions from Present Pool Elevation	1.0
Liquefaction	1.3

In Sections 3.3.1 and 3.3.2 we discuss our review of the effects of overtopping, stability analyses, and performance of the Bottom Ash Pond and Stingy Run Dam, respectively.

3.3.1 Bottom Ash Pond

AEP developed a scope of work to perform a geotechnical assessment to provide an indication as to the level of safety provided by the embankment dikes creating the Bottom Ash Pond. A Draft

Bottom Ash Investigation Report was prepared by BBCM Engineering, Inc. in June 2009. The scope of work consisted of the following;

- Advancement of a total of seven borings;
- Installation of four monitoring wells;
- Laboratory testing on the recovered samples; and
- Engineering analyses of the existing embankments at the investigated sections with consideration to seepage, steady state slope stability and seismic slope stability.

Static steady state and seismic slope stability analyses were performed on the downstream (outboard) embankment slopes for two cross sections. Two strata were modeled below the Bottom Ash Pond embankment. According to BBCM's report, the permeability and shear strength parameters used to represent the fill were based on the totality of test data available across the entire site. The natural alluvium soils encountered in the borings below the embankment fill were also found to be highly variable, consistent with the depositional environment of such soils and BBCM used parameters based on the totality of test data available across the entire site.

The shear strength and unit weight values used for the slope stability analyses were reportedly based on a combination of the laboratory index test results, triaxial shear test results, published values and correlations, and judgment and were intended to be representative of long term conditions (drained). To estimate the effective friction angle of the cohesive embankment fill and alluvium layers several correlation methods were examined and laboratory shear strength tests were performed on the embankment fill as well. The properties of the four strata model in the analyses are provided in Table 4.

Table 4 - Soil Strength Parameters Used in BBCM June 2009 Draft Investigation Report

Soil Stratum	Unit Weight (pcf)	Friction Angle (φ)	Cohesion (psf)	Description
Cohesive Embankment Fill	125	28°	100	Embankment
Roadway Fill	125	30°	0	Embankment
Alluvium Silt/Clay	125	29°	0	Natural Subgrade
Glacial Outwash Sand/Gravel	120	32°	0	Natural Subgrade

At the time of the topographical survey on March 27, 2009 performed as part of the BBCM investigation, the pool level in the bottom ash pond was at EL 577.9 feet, resulting freeboard ranges between approximately 16 and 21 feet. It is understood that this represents the normal operating pool level, and is consistent with the conditions CHA observed during our June 2009 site visit.

The location of the groundwater table within the embankments was estimated based on extended groundwater readings taken within the observation wells and conditions encountered during drilling. Results from the seepage analysis performed as part of BBCM's investigation provided pore pressure values within the model to be used in the stability analysis.

Seismic analyses were performed using a pseudo static analysis with a horizontal seismic coefficient of 0.06g This coefficient was determined from the 2008 USGS National Seismic Hazard Maps for the Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years.

Table 5 provides a summary of the calculated factors of safety for the loading conditions outlined by the U.S. Army Corps of Engineers in EM 1110-2-1902, Table 3-1. CHA, using the south embankment geometry and soil parameters provided in the June 2009 investigation report, duplicated the downstream embankment slope using the steady state load condition to confirm the factor of safety for this load case provided in the report. Our Slide™ output resulted in a similar factor of safety as shown on Figure 9A.

Table 5 – Summary of Safety Factors

Load Case	Required Minimum Factor of Safety	Calculated Minimum Factor of Safety	
		Section A	Section B
Steady State Conditions at Present Pool or Flood Elevation (Downstream Slope) (See Figures 8A and 8B)	1.5	1.7	1.5
Rapid Draw-Down Conditions from Present Pool Elevation	1.3	Not Performed as Part of the BBCM Evaluation	
Maximum Surcharge Pool (Flood) Condition	1.4	Not Performed as Part of the BBCM Evaluation	
Seismic Conditions from Present Pool Elevation (See Figures 8C and 8D)	1.0	1.4	1.2
Liquefaction	1.3	Not Performed as Part of the BBCM Evaluation	

Review of the Slide™ outputs and corresponding factors of safety for the various loading conditions, boring logs, laboratory test data and parameter justifications provided in the appendices of the June 2009 investigation report indicate the following;

- The factor of safety for the upstream (inboard) embankment slope of the pond was not evaluated as part of BBCM's June 2009 investigation. CHA modeled the upstream slope using the south embankment geometry and the steady state loading condition (see Figure 9B) and the soil parameter provided in BBCM's report. The calculated factor of safety was 1.3 which is below the minimum required factor of safety (according to the USACOE).

- A model was not developed for the maximum surcharge pool (flood) condition as part of the June 2009 investigation.

- Review of the boring logs indicates that the alluvium silt/clay had a layer of significantly lower SPT N-values. For example, boring B-0904 contains a layer of alluvium with sample effort or blow counts equal to the weight of the hammer at approximately 16 feet below the existing ground surface. This soft layer continues to approximately a depth of 30 feet. Hand penetrometer tests performed on samples retrieved during drilling operations ranged from 0.0 to 1.25 tsf. The alluvium silt/clay layer in BBCM's June 2009 investigation was modeled as one layer with a friction angle of 29 degrees. It may be more appropriate to model the alluvium in more that one layer with corresponding strength parameters to more accurately reflect field conditions. The downstream slope stability outputs for the steady state load condition for Cross Sections A and B show failure planes within the embankment soils. If the alluvium silt/clay was modeled with a soft layer at the depth corresponding to the low sample effort the failure plain may actually fail within the alluvium foundation soils and not the embankment soils.

- The rapid-draw down load case was not evaluated as part of the June 2009 investigation. CHA modeled the south embankment slope using a combination of soil parameters provided in the June 2009 investigation report and parameters which may more closely represent field conditions (i.e. undrained embankment and alluvium soils on the upstream slope and a softer alluvium silt/clay layer). Figure 9C indicates that the calculated factor of safety for the rapid draw-down load condition is close to 1.0, which is below the minimum required value of 1.3 (according to the USACOE).

- A liquefaction analysis was not performed as part of the June 2009 investigation.

Section 4.11 outlines our recommendations for tasks that should be performed to confirm that the embankments are stable under the loading conditions discussed above.

3.3.2 Stingy Run Dam

Soil borings, cone penetration tests, and laboratory testing were performed on the original portion of the dam in preparation for designing the raising in 1986. These data in combination with data collected during the design of the original dam were used by AEP to evaluate the stability of the raised dam. Table 6 summarizes the soil parameters were used in the evaluation of the raised dam. CHA has not reviewed the "End of Construction" data for this evaluation as the dam has been in the raised condition for 21 years (since 1988) and therefore has more than likely reached a "Steady State" condition.

Table 6 - Soil Strength Parameters Used in the 1986 Dam Raising Evaluation

Material	C (psf)	ϕ (degrees)
Fill Materials		
1988 Upstream Clay Core	700	16
1988 Downstream Random Fill	800	16
Bottom Ash	0	39
1974 Clay Core	0	23
1974 Downstream Random Fill	0	25
1974 Upstream Random Fill	0	21
Upstream Fly Ash	0	0
Foundation Materials		
Upper Clay	860	21
Upper Sand	0	30
Intermediate Clay	0	22
Lower Sand	0	30
Lower Clay/Shale	0	22

The stability analyses were performed for the maximum pool, based on using the Stingy Run impoundment for fly ash disposal until full, which would have continually, year to year, raised the normal operating pool based on the volume of disposed fly ash. Because fly ash disposal into the Stingy Run impoundment ceased in 1994, the current normal pool is about 28 feet below the design pool. CHA reviewed piezometer data provided by AEP and compared the phreatic surface in the dam to the design elevation. CHA concluded that the current phreatic surface ranges between 30 to 40 feet below the design phreatic surface which is consistent with the lower operating pool, and favorable from a stability perspective.

Table 7 summarizes the minimum factors of safety computed by AEP, and peer reviewed by their outside consultant as part of the dam raising design.

Table 7 – Summary of Safety Factors – Stingy Run Dam

Load Case	Required Minimum Factor of Safety	Calculated Minimum Factor of Safety
Steady State Conditions at Present Pool Downstream Slope ▪ Shallow Wedge Analysis ▪ Deep Wedge Analysis	1.5	 1.5 1.5
Steady State Conditions at Present Pool Upstream Slope ▪ Partial Pool – El. 685 feet ▪ Full Pool – El.726 feet	1.5	 1.5 1.8
Rapid Draw-Down Conditions from Present Pool Elevation	1.3	Not Performed
Maximum Surcharge Pool (Flood) Condition (El. 731 feet)	1.4	Not Performed
Seismic Conditions from Present Pool Elevation Downstream Slope ▪ Shallow Wedge Analysis ▪ Deep Wedge Analysis	1.0	 1.3 1.2
Seismic Conditions from Present Pool Elevation Upstream Slope	1.0	1.4
Liquefaction	1.3	Not Performed

- Rapid Drawdown – The design report prepared by AEP reads "Because of the manner of reservoir useage the proposed dam raising is not being evaluated in the rapid drawdown loading condition." While CHA can understand that it would be undesirable to rapidly evacuate water containing suspended fly ash from an impoundment, in the current operation of the Stingy Run Dam, existing fly ash is covered and the impounded water is free of "added" suspended solids, although it may contain suspended solids based on the overland runoff and other impoundment characteristics. Therefore, CHA suggests that in the event of an emergency at the dam (the classic rapid drawdown scenario) it may be favorable to evacuate impounded water to reduce stresses on the dam to reduce the risk of an uncontrolled release in the event of failure. Therefore, CHA recommends that a rapid drawdown analysis be performed for the Stingy Run Dam in the current configuration.

- Maximum Surcharge – No analysis was performed for the flood pool condition. CHA understands from our review of the H&H analyses (see Section 3.2.2) that in the event of the design storm (PMP) the water level in the impoundment will rise to about El. 731. We recommend a maximum surcharge stability evaluation be performed for the current conditions.

- Liquefaction – No liquefaction analysis was performed. CHA reviewed logs provided in the dam raising design report, and agrees based on the level of review associated with this evaluation that there is not likely a liquefaction potential at this site. However, as seen in the summary of soil properties and strata used in the stability analyses in Table 6, CHA recommends that AEP confirm that the Upper Sand and Lower Sand strata do not pose a liquefaction risk at this site.

The Stingy Run Dam is also instrumented with both horizontal and vertical deformation monitoring points and two slope inclinometers. Data is collected from these instrument points twice a year. CHA reviewed the latest deformation monitoring summary provided by AEP which included data through November 2008. AEP predicted settlements for the dam raising of

2.8 feet. Their evaluation included adjusting soil parameters based on observed settlements of the original dam significantly (about 10% of predicted) less than predicted.

Settlement monitoring points along the crest and downstream slope have shown settlements ranging between 2 and 6 inches over the 20 years of monitoring data. Inclinometer SI-1 has shown a total of about 6 inches of downstream deformation since its installation. Data was provided for this inclinometer back to 2006, during which time period there has been negligible movement. Inclinometer SI-2 has exhibited about 1 inch of downstream movement since its installation. Only data from 2007 and 2008 was provided, but during this 2 year time period negligible movement occurred.

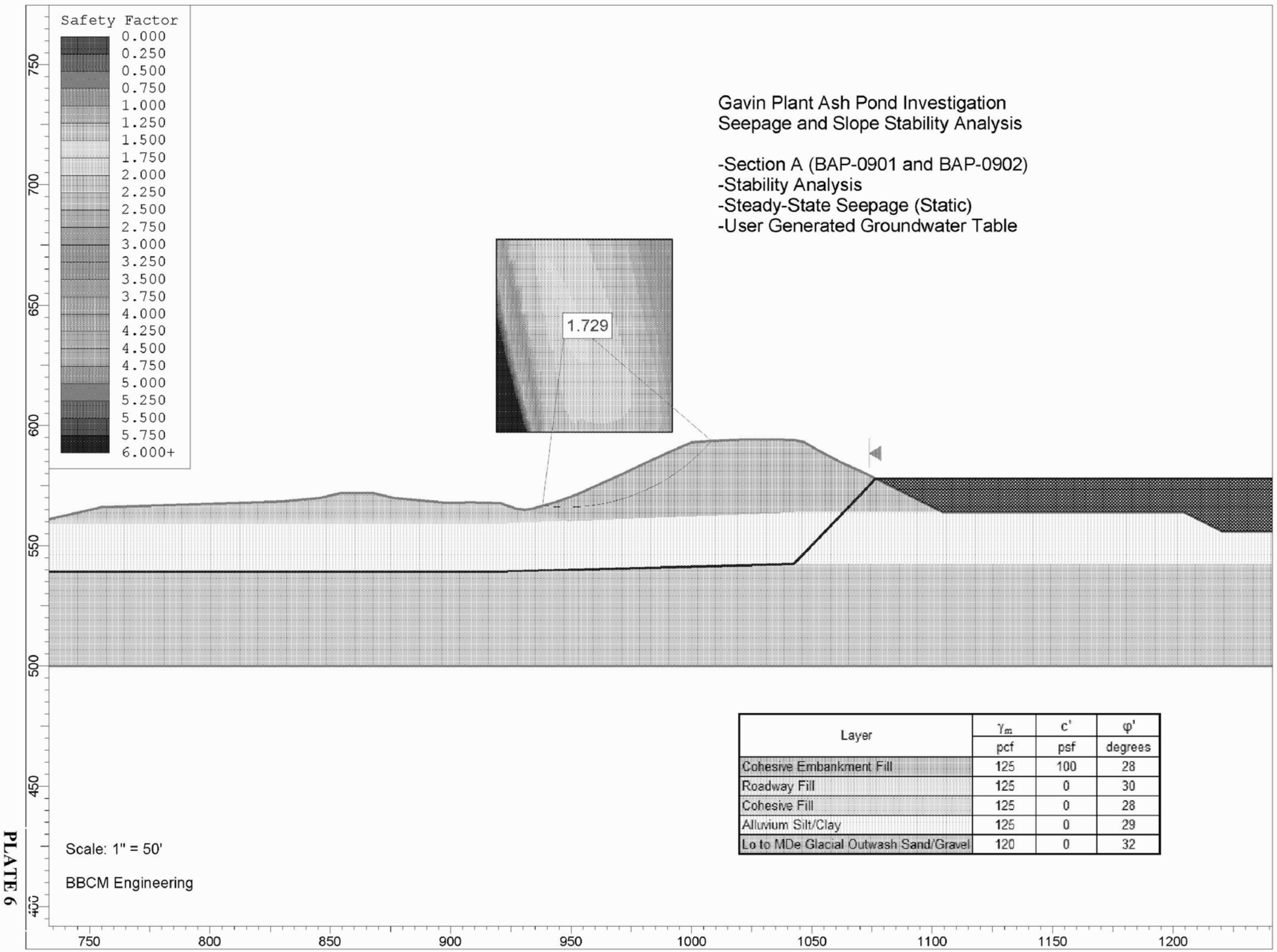
These measurements are consistent with the design stability of the dam. AEP should continue to be vigilant in monitoring the instrumentation at this facility as a way of evaluating the performance of the dam.

3.4 Operations & Maintenance

AEP General James Gavin Power Plant staff make quarterly inspections of the Bottom Ash Pond and Stingy Run Dam. Maintenance staff from the plant make daily visits and broad view observations daily. On an annual basis, AEP engineers from the Columbus, Ohio office perform inspections of these facilities. And Ohio DNR Dam Safety personnel perform an inspection every 5 years. Between 1978 and 1998 a biannual third party inspection was made, although this practice was discontinued in 1998.

Piezometer and V-notch weir readings are taken during the quarterly inspections, and the settlement monuments and slope inclinometers at Stingy Run Dam are surveyed twice a year by AEP's Civil Laboratory Section. A summary of these instrumentation data are included in Figures 10A, 10B, and 10C.

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 1:08:33 PM Plotted: 7/2/2009 4:25:06 PM User: Filkins, Rebecca



Layer	γ_m	c'	φ'
	pcf	psf	degrees
Cohesive Embankment Fill	125	100	28
Roadway Fill	125	0	30
Cohesive Fill	125	0	28
Alluvium Silt/Clay	125	0	29
Lo to MDe Glacial Outwash Sand/Gravel	120	0	32

PLATE 6

AEPGV002973

IMAGE REFERENCE: BBC&M BOTTOM ASH POND STABILITY ANALYSIS REPORT, APPENDIX D, PAGE 7

Drawing Copyright © 2007 CHA

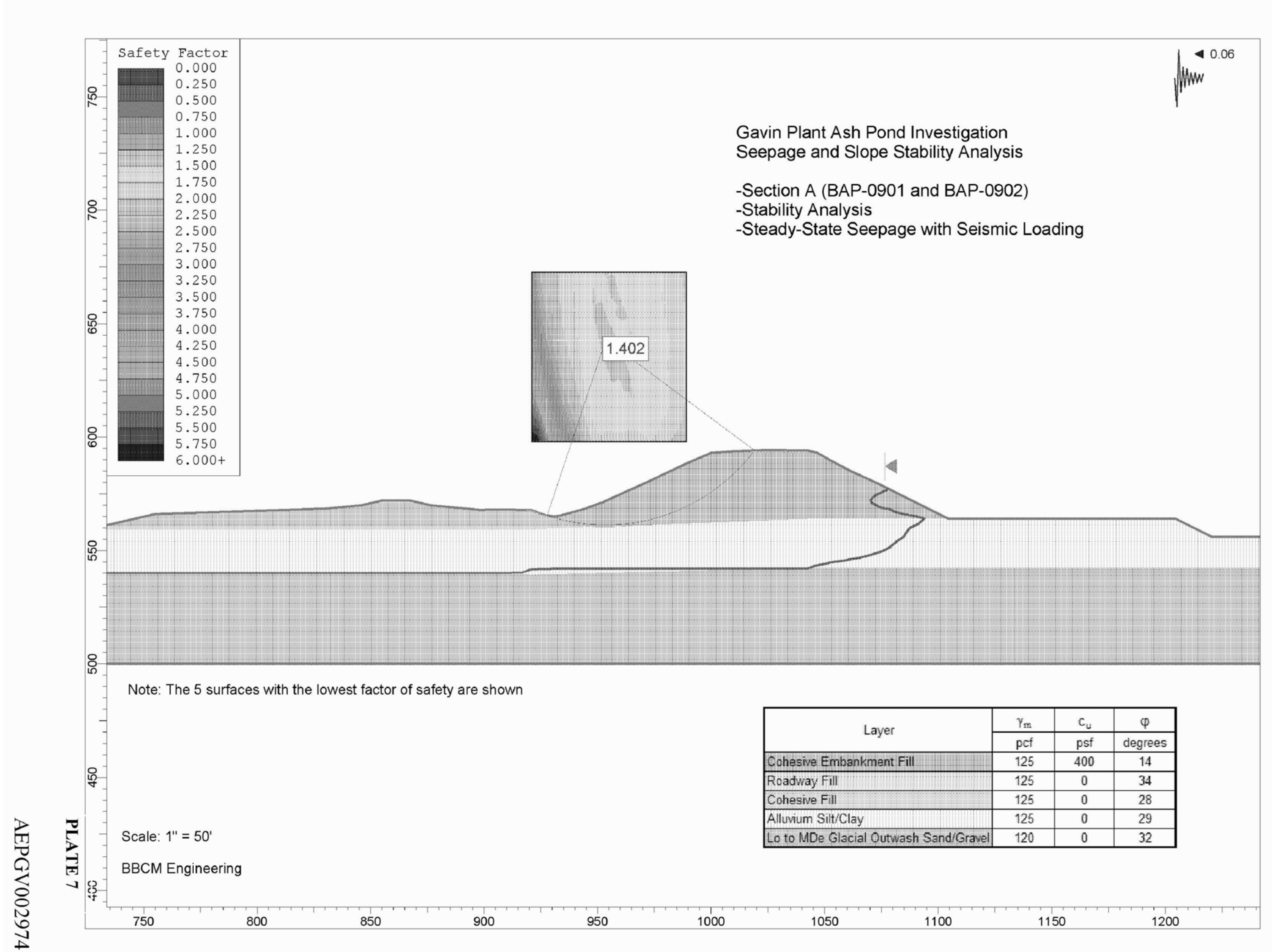
CHA

BOTTOM ASH POND SLOPE STABILITY
SECTION A
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 8A



Layer	γ_m	c_u	φ
	pcf	psf	degrees
Cohesive Embankment Fill	125	400	14
Roadway Fill	125	0	34
Cohesive Fill	125	0	28
Alluvium Silt/Clay	125	0	29
Lo to MDe Glacial Outwash Sand/Gravel	120	0	32

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 1:08:33 PM Plotted: 7/2/2009 4:26:25 PM User: Filkins, Rebecca

IMAGE REFERENCE: BBC&M BOTTOM ASH POND STABILITY ANALYSIS REPORT, APPENDIX D, PAGE 8

Drawing Copyright © 2007 CHA

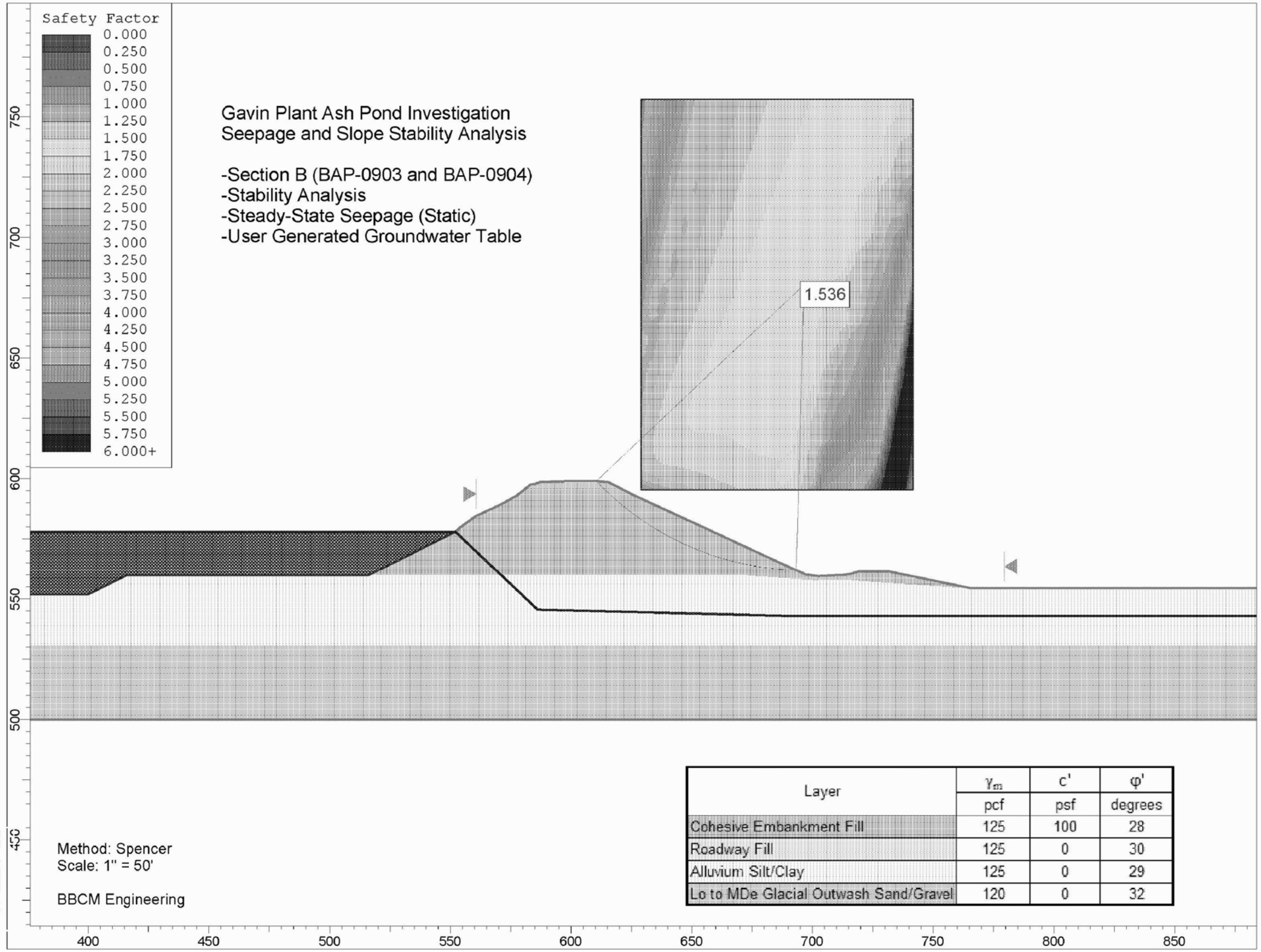
CHA

GAVIN PLANT ASH POND
SLOPE STABILITY SECTION A
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 8B



Layer	γ_m	c'	φ'
	pcf	psf	degrees
Cohesive Embankment Fill	125	100	28
Roadway Fill	125	0	30
Alluvium Silt/Clay	125	0	29
Lo to MDe Glacial Outwash Sand/Gravel	120	0	32

PLATE 12

AEPGV002979

IMAGE REFERENCE: BBC&M BOTTOM ASH POND STABILITY ANALYSIS REPORT, APPENDIX D, PAGE 13

Drawing Copyright © 2007 CHA

CHA

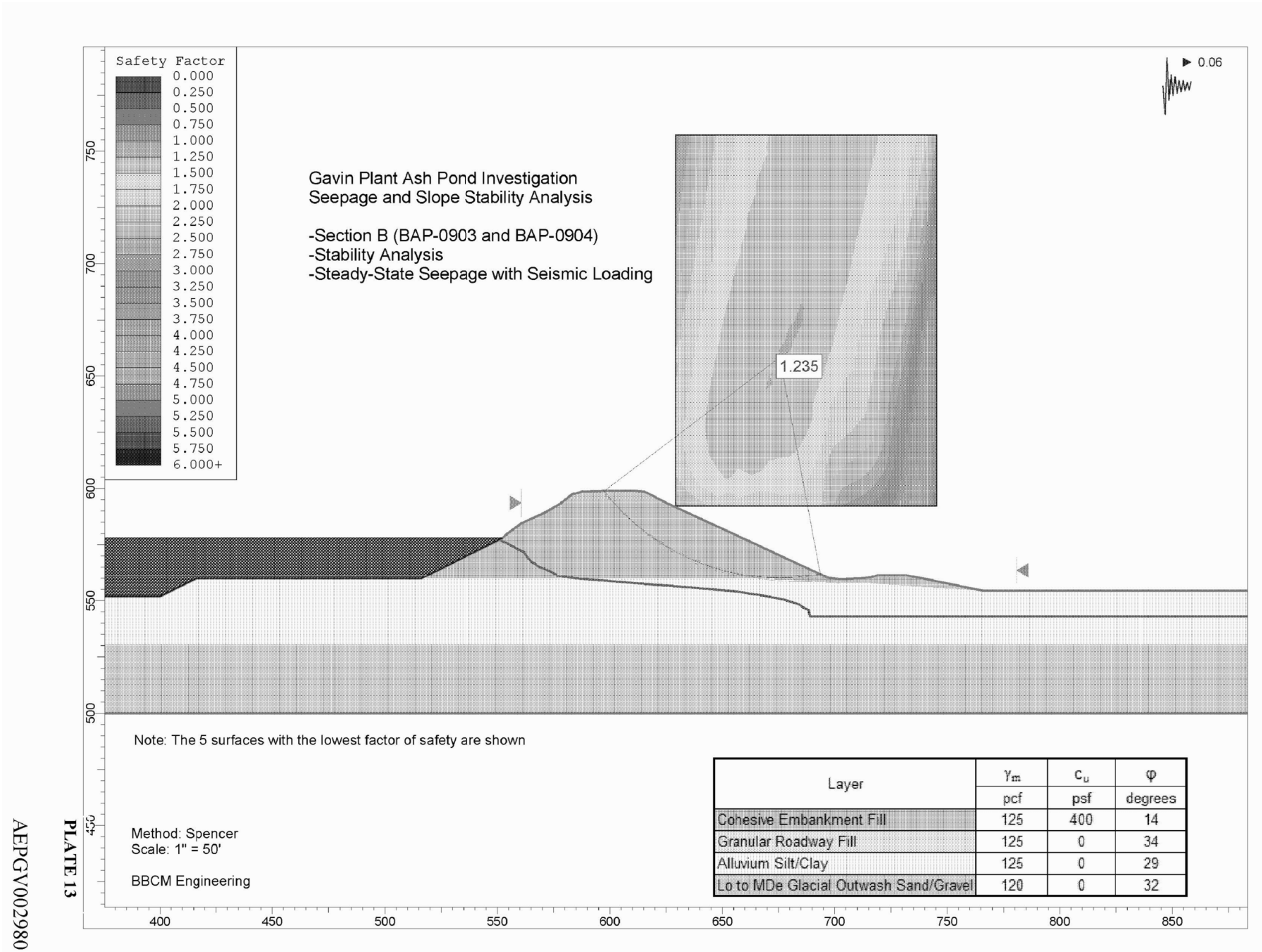
GAVIN PLANT ASH POND
SLOPE STABILITY SECTION B
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 8C

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 1:08:33 PM Plotted: 7/2/2009 4:27:53 PM User: Filkins, Rebecca



Layer	γ_m	c_u	φ
	pcf	psf	degrees
Cohesive Embankment Fill	125	400	14
Granular Roadway Fill	125	0	34
Alluvium Silt/Clay	125	0	29
Lo to MDe Glacial Outwash Sand/Gravel	120	0	32

IMAGE REFERENCE: BBC&M BOTTOM ASH POND STABILITY ANALYSIS REPORT, APPENDIX D, PAGE 14

Drawing Copyright © 2007 CHA

CHA

GAVIN PLANT ASH POND
SLOPE STABILITY SECTION B
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 8D

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 1:08:33 PM Plotted: 7/2/2009 4:28:56 PM User: Filkins, Rebecca

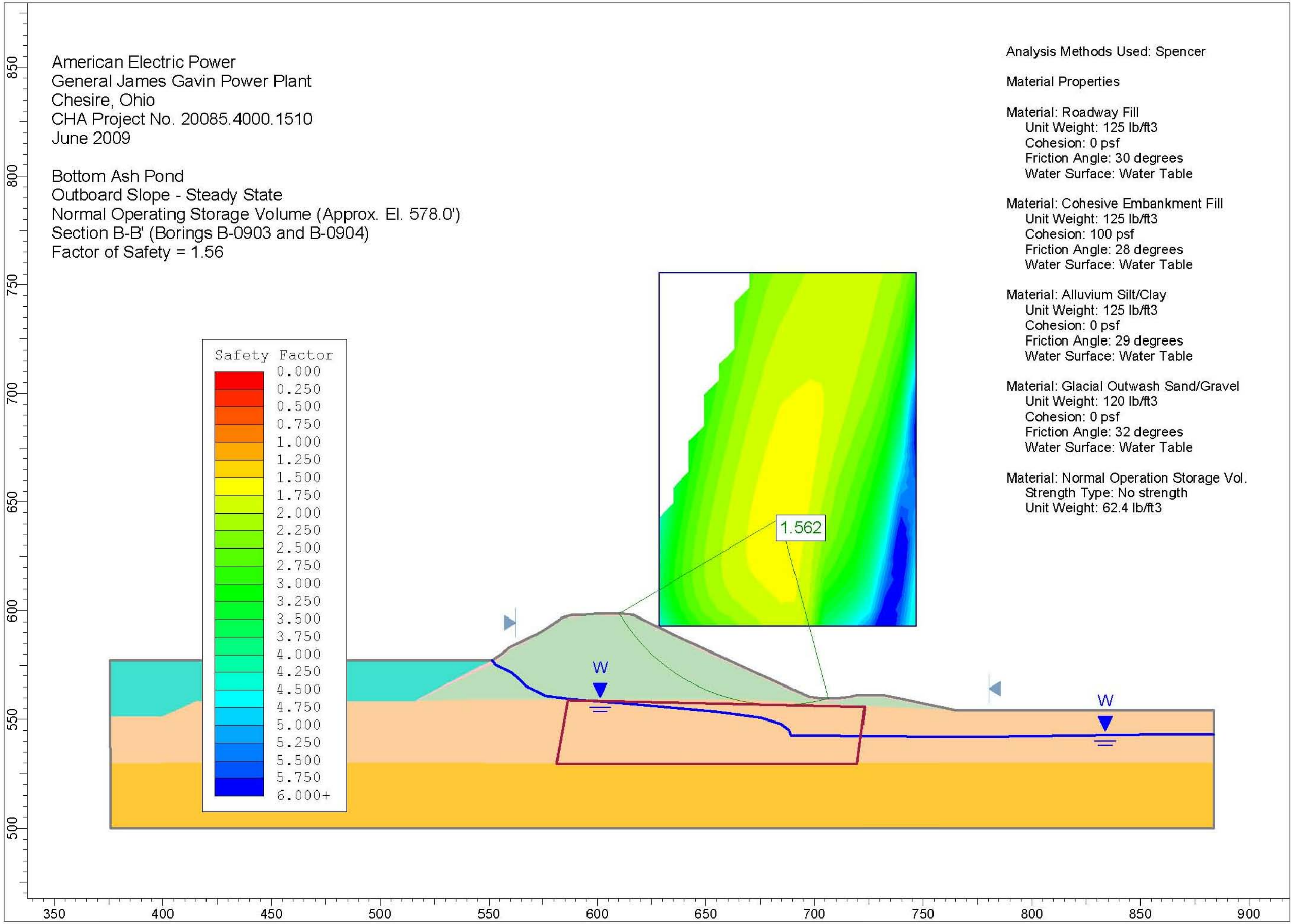


IMAGE REFERENCE: 07-01-09 GAVIN OUTBOARD STEADY STATE

Drawing Copyright © 2007 CHA

CHA

BOTTOM ASH POND SLOPE STABILITY
OUTBOARD STEADY STATE
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 9A

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 4:30:31 PM Plotted: 7/2/2009 5:49:19 PM User: Filkins, Rebecca

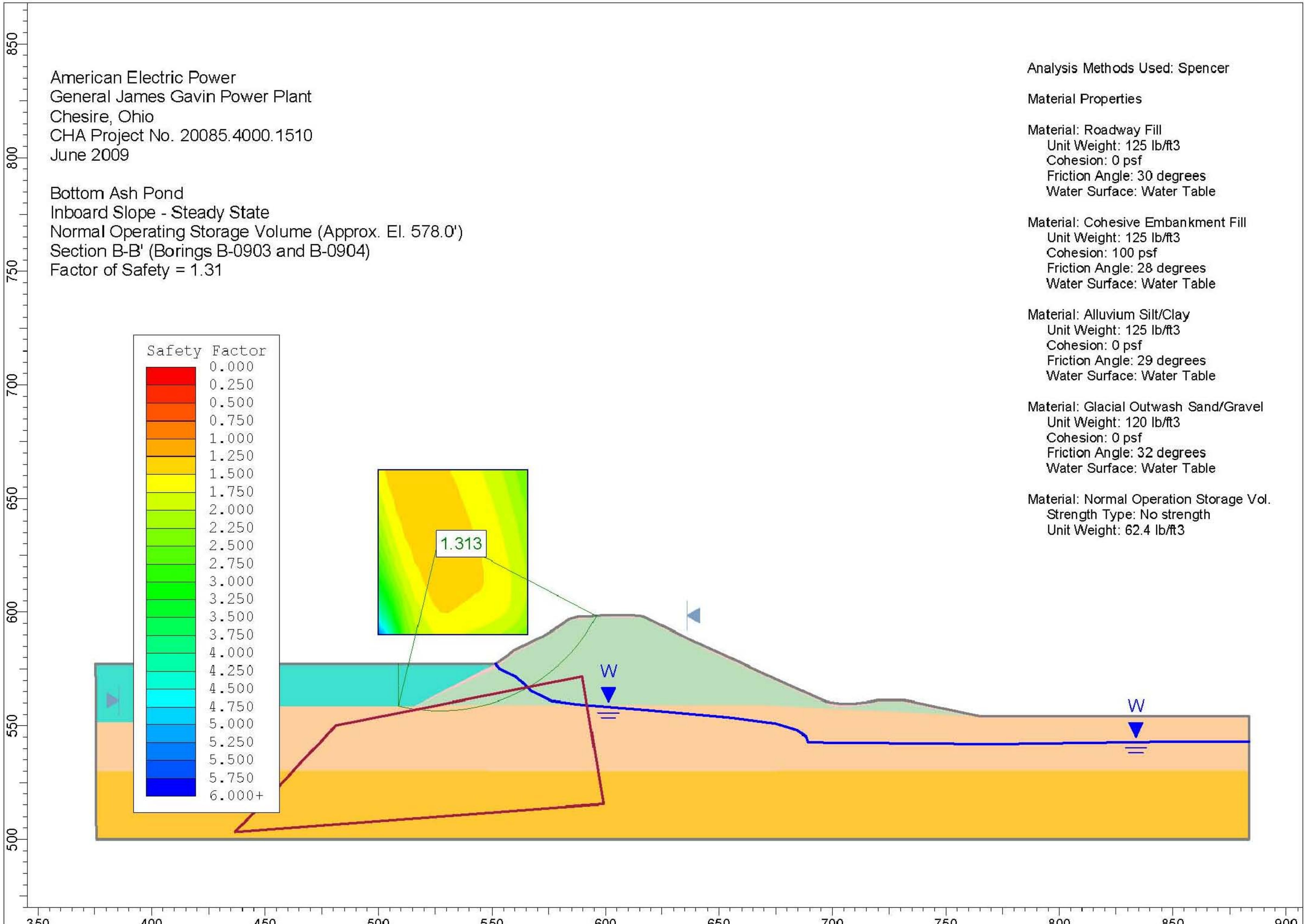


IMAGE REFERENCE: 07-01-09 GAVIN INBOARD STEADY STATE

Drawing Copyright © 2007 CHA

CHA

BOTTOM ASH POND SLOPE STABILITY
INBOARD STEADY STATE
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 9B

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 5:47:07 PM Plotted: 7/2/2009 4:30:31 PM User: Filkins, Rebecca

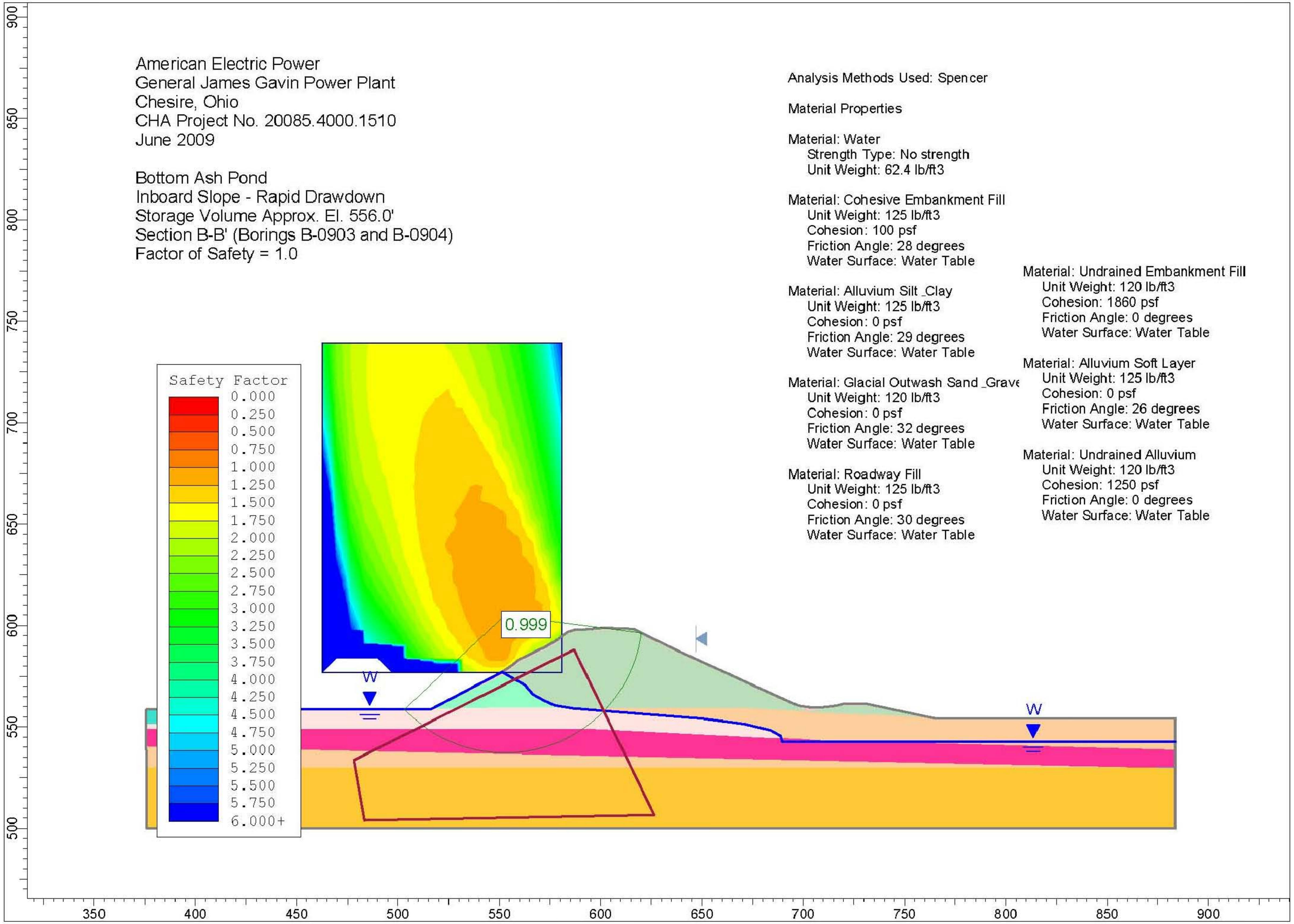


IMAGE REFERENCE: 07-01-09 GAVIN INBOARD RAPID DRAWDOWN

Drawing Copyright © 2007 CHA

CHA

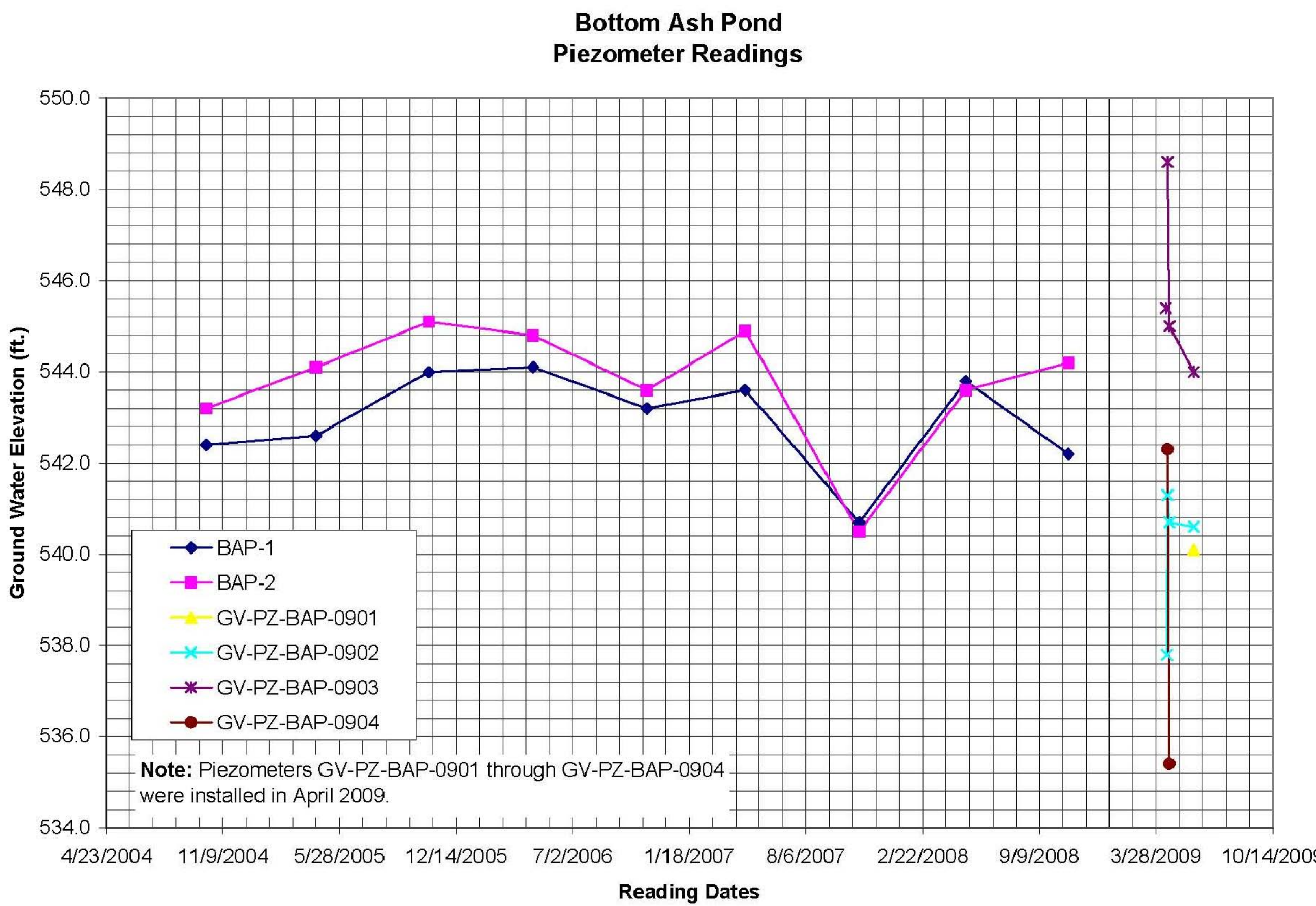
BOTTOM ASH POND SLOPE STABILITY
RAPID DRAW-DOWN STATE
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 9C

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN XSECTIONS.DWG Saved: 7/2/2009 4:30:31 PM Plotted: 7/2/2009 5:44:05 PM User: Filkins, Rebecca



Drawing Copyright © 2007 CHA

CHA

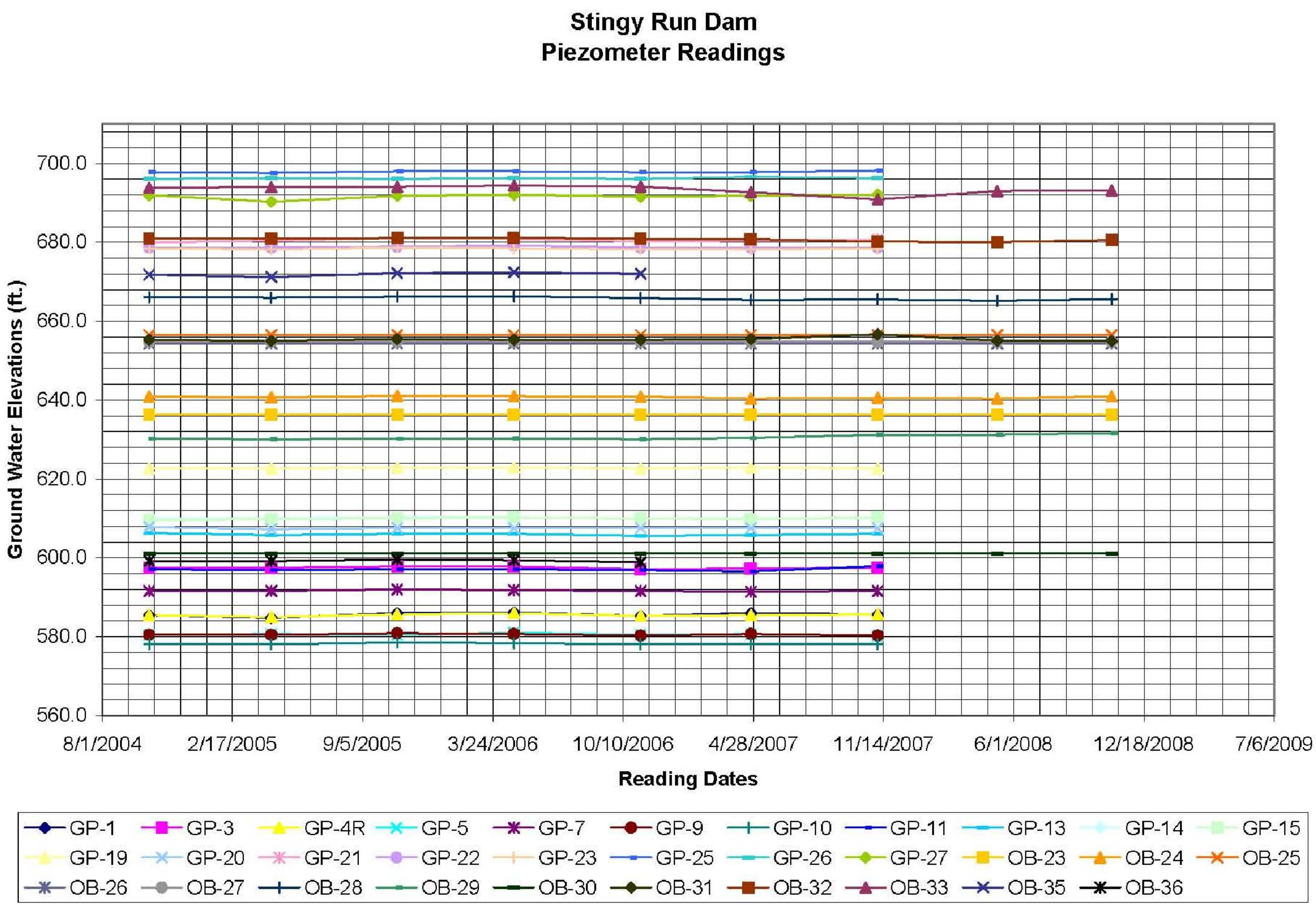
PIEZOMETER READINGS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 10A

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN DATA.DWG Saved: 6/30/2009 3:10:07 PM Plotted: 7/2/2009 6:17:08 PM User: Filkins, Rebecca



Drawing Copyright © 2007 CHA

CHA

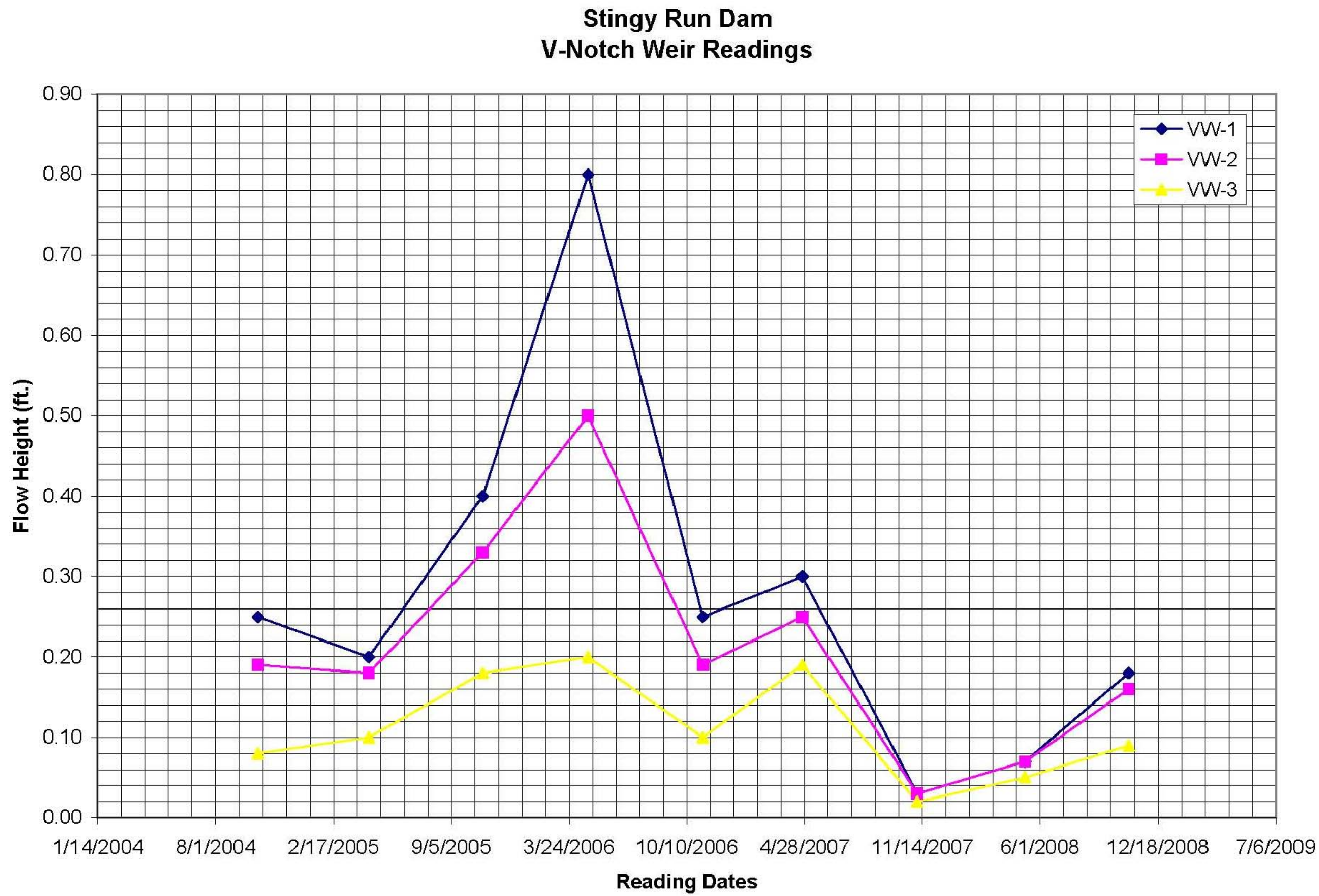
PIEZOMETER READINGS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 10B

File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN DATA.DWG Saved: 6/30/2009 3:10:07 PM PLotted: 7/2/2009 6:19:24 PM User: Filkins, Rebecca



File: K:\20085\CADD\ACAD\FIGURES\GEO\4000 GEN JAMES GAVIN\4000 GAVIN DATA.DWG Saved: 6/30/2009 3:10:07 PM Plotted: 7/2/2009 6:22:41 PM User: Filkins, Rebecca

Drawing Copyright © 2007 CHA

CHA

PIEZOMETER READINGS
GENERAL JAMES GAVIN POWER PLANT
AMERICAN ELECTRIC POWER
CHESHIRE, OHIO

PROJECT NO. 20085.4000

DATE: JULY 2009

FIGURE 10C

4.0 CONCLUSIONS/RECOMMENDATIONS

4.1 Acknowledgement of Management Unit Condition

I acknowledge that the management unit reference herein was personally inspected by me and was found to be in the following condition: **Fair.**

CHA's assessment of the Bottom Ash Pond and Stingy Run Dam indicate that they are in fair condition. Evidence was observed indicating that AEP attempts a proactive maintenance and monitoring program at these facilities. These efforts should be continued.

CHA presents recommendations for maintenance and further studies to bring these facilities into Satisfactory in the following sections.

4.2 Maintaining Vegetation Growth

The vegetation growth was cut on the embankments immediately prior to our site visit and during our site visit. We recommend that vegetation be cut prior to each quarterly performed by AEP representatives so that adequate visual inspections can be made.

4.3 Bottom Ash Pond South Dike Upstream Slope Stabilization and Wet Area

The upstream slope of the South Dike at the Bottom Ash Pond has experienced several surficial slumps, which are likely the result of over steepening of the slope by crest road grading activities which has resulted in a widening of the crest in combination with undercutting from wave action.

CHA recommends the upstream slope be re-graded to correct the steepness and slumped areas for stabilization. This effort should be coordinated with the recommendations made in Section 4.11 to analyze the upstream slope.

4.4 Bottom Ash Pond South Dike Wet Area

At about the mid-point along the length of the south dike downstream slope, there is a wet area which appears to be perched water on surface soil layers. The area was recently re-graded to improve drainage. This area should be monitored on a continual basis. Should a change be observed in this area during an inspection a qualified engineer should further evaluate this new condition.

4.5 Bottom Ash Pond East Dike Erosion

Areas of erosion gullies along the transition from the crest to the downstream slope where observed during our site visit. AEP should continue to monitor these areas and perform repairs, as part of ongoing maintenance of the dikes. Repairs should included stabilizing the areas with seed and mulching the areas to establish better vegetation.

4.6 Bottom Ash Pond East Dike Repair of Rodent Holes

As discussed in Section 2.2.1.2 – East Dike, several large rodent holes were observed. A few of these appeared to be plugged and AEP personnel indicated that they have had to trap rodents from time to time. CHA recommends that AEP continue with efforts to plug these holes and trap rodents. In addition, noting the locations that have been plugged will provide a record which can be used to more easily identify active versus inactive rodent burrows (i.e. stable versus potentially changing conditions).

4.7 Bottom Ash Pond East Dike Tree and Stump Removal

As discussed in Section 2.2.1.2 – East Dike, there are a few tree stumps along the toe of the east dike. AEP personnel did not know when these trees were cut or why the bench with the access road was apparently constructed around them. These stumps should be monitored for decay and the stumps and associated root balls removed under the direction of a professional engineer.

Several small diameter trees were observed at the water line around the pond. These trees have been allowed to grow despite routine mowing efforts. CHA recommends that these trees be cut and the root mass be left in place for trees less than 5 inches in diameter. Trees equal to or larger than 5 inches in diameter should have the root masses removed under the direction of a professional engineer.

4.8 Bottom Ash Pond North Dike Runoff from Flushing the Conveyor

Previous inspection reports indicated that there was an area at the northeast corner where runoff from flushing dust from the coal conveyor was resulting in an erosion gully on the downstream slope. A concrete pad and knee wall was placed under the coal conveyor at this location to minimize the impact of routine cleaning of the coal conveyor on the dike. There are other areas along the conveyor at which coal dust runs out of the conveyor during this process. We recommend that best management practices be utilized during flushing operations to minimize erosion of the embankment.

4.9 Bottom Ash Pond Hydraulic Analysis

AEP was not able to provide CHA with a hydraulic analysis showing the Bottom Ash Pond's ability to safely pass the PMP. However, preliminary analyses performed by CHA suggest there is enough storage capacity at the current operating pool to safely withstand this rainfall event. We recommend AEP perform a complete study to confirm this, and update the study if operating levels of the pond change in the future.

4.10 Stingy Run Dam Hydraulic Analysis

We recommend that in the event of a major storm event that raises the pool elevation, AEP closely monitor the behavior of the structure. First filling of a dam is a sensitive time because of changes in stress on the earthen embankment. Because the normal pool and design flood storage elevations are significantly different, it is our opinion that storm events that cause the reservoir elevation to rise should be considered as first filling events and the appropriate level of observation be taken to ensure that the dam is not exhibiting signs of internal erosion, piping and/or other concerns as a result of the surcharge pool.

4.11 Recommendations for Additional Stability Analyses – Bottom Ash Pond

Based on our review of available information for the Bottom Ash Pond we recommend that the following tasks be performed to confirm that the embankments are indeed stable under the various loading conditions outlined in Section 3.3.

- We recommend that an investigation be performed in which the properties of the alluvium silt/clay layer can be investigated in more detail in order to determine the presence and thickness of the soft layer of material indicated in the boring logs from June 2009. This scope of work should include laboratory testing of samples retrieved from the alluvium layer.
- We recommend that a stability analysis model be developed for the maximum surcharge pool (flood) condition. The model should reflect soil parameters for the soft alluvium layer described above. Because the observed and BBCM calculated phreatic surface within the embankment does not reflect a "classic" shape, we recommend a seepage analysis at flood pool be developed and subsequent stability model be analyzed.

- CHA modeled the upstream slope using the south embankment geometry and the steady state loading condition and the soil parameter provided in the June 2009 report. The calculated factor of safety was 1.3 which is below the minimum required factor of safety (according to the USACOE). We recommend that a model be prepared for this load case using the soil parameters for the soft alluvium layer described above.

- The downstream slope stability outputs for the steady state load condition for Cross Sections A and B show failure planes within the embankment soils. If the alluvium silt/clay was modeled with a soft layer at the depth corresponding to the low sample effort the failure plain may actually fail within the alluvium foundation soils and not the embankment soils. We recommend that a model be prepared for this load case using the soil parameters for the soft alluvium layer described above.

- The rapid-draw load case was not evaluated as part of the June 2009 investigation. CHA performed a preliminary analysis of the south embankment slope which indicated that the calculated factor of safety for the rapid draw-down load condition is close to 1.0, which is the minimum required value (according to the USACOE). We recommend that a model be prepared for this load case.

- We recommend that a liquefaction analysis be performed, especially if it is determined during the recommended investigation of the soft alluvium layer that the soils are susceptible to liquefaction.

4.12 Stingy Run Dam Recommendations for Additional Stability Analyses

Based on our review of available information for the Bottom Ash Pond we recommend that the following tasks be performed to confirm that the embankments are indeed stable under the various loading conditions outlined in Section 3.3.

- CHA recommends that AEP confirm that the Upper Sand and Lower Sand strata do not pose a liquefaction risk at this site.

- CHA recommends a maximum surcharge stability evaluation be performed for the current conditions.
- CHA recommends a rapid drawdown analysis be performed for the current conditions.

4.13 Stingy Run Dam Outlet Structure Access

The access stairs and floating bridge to the Stingy Run outlet tower were barricaded in 2008 by AEP because of advanced deterioration. We recommend that the access to the tower be repaired so continued monitoring of the condition of the outlet structure can be made during the routine inspections.

4.14 Stingy Run Dam Destroyed Instrumentation

We recommend AEP evaluate the need for and/or replace instrumentation that has been destroyed at the Stingy Run Dam. We understand that mower damage and vandals have been a problem at this site. Additional protection may be needed at the instrument locations to protect against this damage.

5.0 CLOSING

The information presented in this report is based on visual field observations, review of reports by others and this limited knowledge of the history of the General James Gavin Power Plant surface impoundments. The recommendations presented are based, in part, on project information available at the time of this report. No other warranty, expressed or implied is made. Should additional information or changes in field conditions occur the conclusions and recommendations provided in this report should be re-evaluated by an experienced engineer.